PHOTOGRAPHY MADE EASY.

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A
PRACTICAL MANUAL
OF

PHOTOGRAPHY,

CONTAINING FULL AND PLAIN DIRECTIONS FOR THE ECONOMICAL PRODUCTION OF REALLY GOOD

DAGUERREOTYPE PORTRAITS,

AND EVERY OTHER VARIETY OF

PHOTOGRAPHIC PICTURES,

ACCORDING TO THE

LATEST IMPROVEMENTS.

ALSO,

THE INJUSTICE AND VALIDITY OF THE PATENT CONSIDERED,

With suggestions for rendering such a Patent a virtual Dead Letter, etc.

BY A
PRACTICAL CHEMIST AND PHOTOGRAPHIST.

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INTRODUCTION

HAVING long made this fascinating Art a favourite study and pursuit, and succeeded in producing some singularly good results, the author of this little Treatise, after repeated solicitations from his friends, has at length consented to make his process public.

However, lest it should be imagined that our purpose has already been forestalled, we must venture one slight remark in the first place. We can at once deny that a work of this kind is uncalled for on our part, merely because many other—so denominated—Manuals of Photography have recently issued from the press. In fact, the author is persuaded that a really *practical* work upon the subject is yet a desideratum, and he has every reason to believe that the public is mostly of the same opinion. Indeed, he might be fully justified in affirming that—with, perhaps, one or two honourable exceptions—previously published Manuals of Photography have been, too frequently, mere compilations "made"—like the Jew pedlar's razors—" to sell" or, at the best, the production of some theorist.

The Daguerreotype process, or, as we prefer calling it, *photographic delineation* of objects upon metallic plates—the most beautiful of recent discoveries—will, it is hoped, be rendered as interesting to the readers, as it has been to the writer of this little Manual of the Art, by their being freely presented with the results of not only his personal experience in the process, but by adding also the improvements suggested by the researches of the many eminent scientific men, whose attention has

been so ardently devoted to the progress of the art, and whose labours have given to the discovery a degree of perfection which seems almost incredible, considering its yet brief existence. The disgraceful patent by which certain parties have sought to render photography a sealed process to the scientific, and thus to deprive the art itself of the benefit likely to accrue from the well conducted experiments of less selfish men than those who boast themselves its "discoverers," demands primary attention.

England is the only country in the *whole world* (the art having been distinctly and fairly presented by the French Government to the *whole world*) where such "exclusive right" exists; and even here it required not a little tact and talent—with some prevarication on the part of Daguerre's friend Arago—to retain so unjust a monopoly. This "patent," indeed, will not admit of any justification—it is, to say the least, but an "ill return" for the liberal reward so freely and so readily bestowed by the French Chamber of Deputies,* upon MM. Daguerre and Niepce,—a reward which, in all probability, would never have been extended to them, and their families, had it been foreseen that it would have enabled *them* to exercise all future power over an invention thus *purchased* from them. M. Duchatel, Secretary of State, explicitly assigned as a reason for rewarding the discoverers with handsome pensions that "*the invention did not admit of being secured by patent, for, as soon as published, all might avail themselves of its advantages!*" Most certainly the conduct of M. Daguerre and his associates in this affair is unworthy the liberal spirit which should actuate the follower of science or of art.

Before proceeding to describe, in due order, the various processes of the wonders to be achieved by this "new found art," it may first be necessary that we should apprize the reader that attempts have been made, and still are continued, to prevent English amateurs and scientific men from improving upon this invention! "Thus far shalt thou go—and no further," exclaims Monopoly!

That a *monopoly* does exist cannot be denied, and that it exists in a manner both unjust and injurious is equally apparent. It is upheld by means of a patent which, in its origin, was bad, and in its continuance is, we affirm, disgraceful, as must be admitted by any unprejudiced per-

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* In the month of July, 1839, the French Chamber of Deputies granted an annual pension of 6,000 francs to M. Daguerre, and one of 4,000 francs to the son of M. Niepce, with a reversion of half the respective amounts to their wives, in consideration of their *making public* the *details* of this important addition to the powers of science.

son, at all versed in the subject of the patent and common law of the country; and the public should be rendered thoroughly aware, that something like a deception must have been practised upon her Majesty's Attorney General, when he allowed this patent right to be *legalized*, in the *letter*, we should say, for never can it be in the *spirit*. It was clear that Daguerre had no property in the invention when this obnoxious patent was granted as he had previously and entirely sold it to the French Government—and had engaged, in addition to what he then knew to render public all his future improvements and discoveries in the art. We deny, in the first place, that he had the power to sell his original discovery in this or any other country; it only admits of a doubt whether he might fairly withhold the use of the after-improvements *from us* until we had paid for them. Daguerre knows that France thoroughly purchased his secret, and that while she liberally rewarded him, she offered it freely as a gift to the *whole world*—a boon to universal science—a donation to the arts—and that she nobly sought to open out a source of amusement and instruction to every class of society. In the words of an able Edinburgh Reviewer—"All the nations of Europe, save one, and the whole hemisphere of the new world, have welcomed the generous gift. They have received the free use of it for all their subjects; they have improved its processes; they have applied it to the arts; they have sent forth travellers to distant climes to employ it in delineating their beauties and their wonders. In England alone, the land of free trade—the enemy of monopoly—has the gift of her neighbour been received with contumely and dishonour. It has been treated as contraband, not at the Custom-house, but at the *Patent Office*, and much as we admire the principle of our patent laws, as the only reward of mechanical genius under governments without feeling and without wisdom, we would rather see them utterly abrogated, than made, as they have been in this case, an instrument of injustice. While every nation in the world has a staff of pilgrim philosophers, gathering on foreign shores the fragments of science and practical knowledge for the benefit of their country, England marshals only a coast-guard of patent agents, not to levy duties, but to extinguish lights; not to seize smugglers, but to search philosophers; not to transmit their captures to the national treasury, but to retain them as fees and profits to interested individuals."

"Nor does the fate of the Calotype redeem the treatment of her sister art. The Royal Society refused to publish its processes in their transactions. No Arago—no Gay Lassac, drew to it the notice of the Government—no recommendation for a national reward—no enterprising artists

started for our colonies to portray their scenery, or repaired to our insular rocks and glens to delineate their beauty, and their grandeur. The inventor was left to find the reward of his labours (which has been satisfactorily proved, led to the discovery of Daguerre's process) in the very doubtful privileges of a patent; and thus have these two beautiful and prolific arts been arrested on English grounds, and doomed to fourteen years' imprisonment in the labyrinths of Chancery Lane!"

We may also quote the well-known fact that the Patent Law of England does not extend its "protection" to the invention of a *Foreigner!* Are we not, then, justified in demanding how it came to pass that, the official guardians of the law were entrapped into the admission of so *singular* a departure from the plainly written "letter," and the as plainly indicated "spirit" of that law? Surely the Attorney General could not have been blinded to the fact that M. Daguerre was neither a native, nor a denizen of Great Britain? On the contrary, the strangely worded preamble to the specification of this patent, satisfactorily evidences that the invention was known, by all parties, as that of an *alien*, and that the applicants for the patent, sought to establish an illegal precedent. Yes, we need only quote Mr. Miles Berry's own words, upon applying for the patent, to demonstrate that he acted merely as an *agent* in this matter:— "*A certain foreigner, residing in France, instructed him to petition Her Majesty to grant her Royal Letters Patent for the exclusive use of this discovery within this kingdom; and that he believes the said foreigner to be the inventor or discoverer of this process for the spontaneous reproduction of images or pictures by the action of light!*"

It would be an insult to the scientific men of England to suppose them capable of standing tamely by submitting to so great a wrong, in which not only themselves, but the nation must be deeply interested. We have had one recent exhibition of an attempt of the patentee to put down even the sale of the apparatus. Mr. Egerton (to whom the art is much indebted for superior and economical forms of apparatus) has been subjected to much annoyance and heavy law charges, in consequence of the patentee having, on an *ex-parte* statement, obtained an injunction against him, which injunction, however, after three days patient hearing, on the 2nd June last past, the Vice-Chancellor DISSOLVED *with costs.*

We append the Vice-Chancellor's judgment, as reported in one of the leading morning journals:—"The injunction was certainly too large, for it prohibited not only the vending, &c., the likenesses, but also the sale of the apparatus; whereas there was not in the specification one word about the sale of the apparatus, which consisted of the most ordinary instruments. The plaintiff was not entitled to monopolise the use

of these instruments, but merely to use them in a particular process. However, what the Court went upon was this:—In his affidavit Mr. Beard had stated that he had no knowledge of the infringement till the 1st February, 1845, nor sufficient evidence until the 26th of the same month. Now, it might be quite true that though he had no legal evidence, yet he must have had some suspicion. And if the defendant's answer, which in this respect was uncontradicted, were true, the plaintiff had, though not full, yet some information. The affidavits were so constructed that the plaintiff might swear truly, though not so fully, to the satisfaction of the Court, as to sustain the injunction. It was to be observed that from the way in which it was pressed on, the injunction was, in fact, obtained *ex-parte. He would not say that the affidavits were untrue, but that they were not sufficiently explicit.* It was quite clear that at the meetings referred to, the defendant had represented to the plaintiff what he was about, and that the plaintiff must have known, that if not an infringement, yet something very like an infringement was going on. Now, it was the bounden duty of the plaintiff, when he sought the aid of this Court, to communicate these facts. He had not done so, and the Court, therefore, acting on the invariable rule, that where a party obtaining an injunction had concealed any material facts within his own knowledge, that the injunction could not be sustained, would dissolve this injunction with costs, with liberty to the plaintiff to mould his action as he pleased, and also to inspect the defendant's process."

We should hope there is sufficient spirit, and a sufficient sense of justice, among our scientific men, to resist the flagrant abuse which it is sought to continue, because, forsooth, a patent has been enrolled. We suppose that the question will ultimately assume a definite shape among the stern realities of the law. We can only believe that its settlement will be on so firm a basis, as to ensure justice to the scientific world in future times. That a precedent will be created, calculated to warn speculators from meddling with the rights of science, either in a narrow or illiberal spirit, and calculated to preserve an infant art from being handled either in an *improper*, or in a rapacious manner.

Look at the matter in another light; shall the use of an instrument—discovered two centuries ago, in fact—be placed in jeopardy by a flimsy patent for an improvement of to-day? If so, the *next* improvement may deprive us of the use of the microscope, or the telescope, and science will be in fetters, bound by the strong arm of the laws of England, exerted in a line of conduct the most unjust. The scientific many may be sacrificed for the aggrandisement of the few, whose chief pretensions to superior merit possibly is, that they know how to reap a rich harvest while the

sickle is confided to their individual keeping. Exclusively of these considerations, we firmly believe the patent of Daguerre to be invalid at the present time for another reason, the process being so entirely different from that set forth in the patent itself; and we will defy any chemist to prove the pure *Iodine of Silver* (the preparation Daguerre professes to use in his patent) either to be sensitive to light, or applicable to portraiture. The other portions, means, and appliances of the process, likewise, radically vary; and, indeed, we should not have the slightest difficulty in proving that the patentee never *used the apparatus*, or adhered to the *directions of Daguerre* in the production of his portraits. In fact, we emphatically affirm that the existing process is totally different from that of Daguerre—the process now generally adopted embodying the improvements and labours of scientific men of various countries.

It is strictly laid down in the law of patents, that the person applying for the same, after the usual preamble, "*shall lay claim to the parts of the discovery that may be justly new, and of his invention also; the adaptation of anything old, and the improvement thereon.*" The reason for this is to enable the public to steer a clear course, and to place them not entirely in the clutches of any patentee. But such was the disgraceful hurry with which this discovery was taken through the patent office, *that this very important compliance with the law was totally forgotten, nothing new is, in fact, claimed,* and yet every thing newly discovered by scientific men, and likely to prove of value in the process, is immediately seized upon, attempted to be tacked to this—as we maintain it to be—invalid patent, and *claimed* by the patentee as a part and parcel thereof. Persons are threatened with proceedings, and the terrors of an injunction held over their heads, if they dare make use of an instrument discovered by Baptista Porta in 1650, and used by Wedgwood, Sir H. Davy, and Sir Anthony Carlisle, forty years ago, or more, to produce pictures upon the various preparations of the Iodine and Chloride of Silver; it was in 1827, M. Niepce came to England, and communicated to the Royal Society an account of his experiments, together with several pictures on *metal plates,* (now in the possession of Dr. R. Brown, of the British Museum,) spontaneously produced by the action of light in the camera obscura; and more recently by Mr. Fox Talbot. Indeed, the latter might, more justly than Daguerre, lay claim to the actual discovery, not only of the paper process, but of the metallic, as it was well known that, in 1838, he had discovered a method of rendering a silver plate sensitive to light, by exposing it to Iodine, and Daguerre's process was not published or known until August, 1839, *just twelve months afterwards!!*

We are also intimately acquainted with a scientific man, who made

both a *mercury box* and a *camera*, to be used in the Photographic manipulations as early as 1829, *ten years before Daguerre's process* was published; and there seems to us nothing unreasonable in the supposition that, as Daguerre was in the habit of paying frequent visits to this country with his dioramic views, he might thus have received some knowledge of what scientific men were here pursuing, and applied the information thus acquired to his own purposes and profit! The properties of Hyposulphate of Soda were also well known, and pointed out as a solvent of metallic compounds, especially those of silver, as early as 1823; this salt, therefore, cannot be considered new, or its application.

In truth, there can be little of *real* strength in *this* patent right. Force it into a court of law—there test the validity and power of *this would-be crushing patent.* Can there be a doubt as to what the result should or would be, in any sensible man's mind? Yet if the patent should be pronounced good, then let the whole body of scientific men meet to petition the Queen in council to remove so obnoxious a clog upon the developement of one of the most wonderful scientific processes of modern days. If with any show of fairness the patentee can prove himself ill-repaid for his original outlay—considering the transaction a mere speculation, (he having, we have heard, and feel inclined to believe, already realised about five-and-twenty thousand pounds by it—not a little return for his investment, even in these money-getting days)*—let arbiters be appointed to inquire into the whole affair, and award a proper amount. Let it be ten times the amount we should believe possible, under all the circumstances of the case, it would be easily raised amongst the immense number so deeply interested in this important subject.

If this cannot be done, beyond a doubt scientific men will seek to avoid the patent by making use of *other materials* than it embraces; there is a wide field open, and a little steady perseverance may entirely super-

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* We may here state that we have received a strong confirmation upon this point, by having seen a letter in the hand writing of the patentee himself, wherein he sets forth amongst the many inducements for a person to buy a license to work the process in the country, the very large gains accruing: he says that the profit upon the portraits

Charged	1 Guinea	is about	18s.
Ditto	30s.	Ditto	25s.
Ditto	2 Guineas	Ditto	34s.
Ditto	4 Guineas	Ditto	70s.

exclusive of the charge of 5s. for colouring each portrait, *the cost of which is not a penny.* After this statement, and a knowledge of the great demand for these portraits, nothing more need be urged for its truth.

sede the present method. It has just been announced that an American gentleman has discovered a mode of rendering plates very sensitive in the camera *without either iodine or bromine;* no doubt others will quickly discover the same here. This would make the present patent an almost virtual dead letter.

Mr. Fox Talbot also pointed out how other metallic surfaces could be made sensitive enough to form a good picture. Might not this hint be easily improved and rendered available? One of the most simple modes, is the exposure of a polished copper plate to the vapour of bromide of iodine, submitted to the light in the camera, and afterwards placed over the vapour of sulphuretted-hydrogen, or of one of the liquid hydro-sulphurets. This vapour produces the picture in different colours upon the plate; and as this image is not destroyed by any subsequent exposure to light, no further fixing process is requisite.

Very tolerable results may be obtained by using plates of copper silvered, with the ordinary silvering compound of chloride of silver, common salt, and cream of tartar. The copper being brought to a perfect polish, is well washed with salt and water; a little of the silvering compound is briskly rubbed over the plate, until it presents a uniform coating of white silver; the plate is immediately washed in clean salt and water, and dried near the fire, by carefully rubbing it with very clean cloths, or what is better, cotton wool. We have found the polish much improved by passing the plate through a very weak solution of iodine in water; a thin film of ioduret of silver is thus formed. It is then exposed to sunshine, and afterwards rubbed with cotton wool dipped in very fine prepared chalk or rotten stone, by which the iodized surface is removed, and a beautifully polished face left to operate on. It is then iodized, and used in the same manner as the other plates.

Gold plates may be rendered as sensitive to the action of light in the camera, as those of silver. Platina is also worthy of attention, and is at the present time cheaper than gold.

Silvered paper may be carefully stuck on a card—when dry sprinkled with dry tripoli, and polished with cotton wool, and the iodizing effected as well as on metallic plates. A piece of glass well covered with silver leaf, may be treated in the same way, and used without polishing. In the place of crude quicksilver, it may be submitted to the fumes of the well-known substance, calomel (red precipitate), &c. The iodine of iron, zinc, or other preparations, may yet be substituted for the pure iodine in the patent, and the patent possibly remain uninfringed. There are other beautiful processes that can be adopted, and present a large scope for investigation and improvement.

The Ferrotype of Mr. Hunt we can especially commend, and we, ourselves, with prepared polished surfaces of ivory, have effected some beautiful results, and these, we hope shortly, in a definite shape, to lay before the public.

We have also been more than once tempted to experimentalize and seek a photogenic agent in a substance chemically composed to imitate the common egg shell; having been struck with the beautiful colours with which the egg can be easily stained, when so prepared, to amuse and delight children. The results of our own attempts have not as yet been sufficiently satisfactory, but we are not without hope, that, by causing the object to impinge upon the surface, and through the application of a heated vapour, to be ultimately successful.

It will be seen from the remarks that we have found occasion to make that our own conviction is strong, that the Daguerreotype process should be as free to the world, from let or constraint, as the sunbeams themselves ; and we think that such a conviction is not only the general, but palpably the correct one. We believe it a duty that we owe to the public as well as to ourselves, that we should allude, in plain terms, to the manœuvres of those *interested* in establishing—and of those who assiduously seek to perpetuate—a *monopoly* of that which clearly belongs to every one,—an invention likely to be exercised and improved by every scientific experimentalist. And it is fit that if we behold artifices employed, discreditable to the scientific world, for the sole purpose of fostering private ends, that we should visit their originators with reprehension.*

With respect to photography itself as comprising the subject of these pages, we would address that class especially who have the happy faculty or ability of appreciating whatever in nature and art is "beautiful exceedingly." To such, the directions our little work may contain, will, we would assume, be found of service, and of interest. It may be as well, therefore, to proceed at once to such details as may assist an operator in the production of a *truly good* photographic picture.

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* In the *Times* of June 16th, 1845, there appeared an advertisement, in which the honourable (?) minded patentee offers to "reward handsomely," any individual who may thereby be *bribed* into a betrayal of private confidence, by supplying him with evidence against any party who may happen to exercise the Protographic process—for scientific improvement, or mere recreation not excepted—without having first purchased a "license" from the Patentee himself. Nay, so anxious is he to obtain evidence against these parties, that he has even resorted—as in the case of Mr. Egerton—to the very disreputable manœuvre of sending a spy to the suspected person, for

The author, however, trusts to be considered as not too egotistical, when he declared this treatise to be the fruit of very many days devoted to the contemplation and patient pursuit of the delightful Art of Photography. In a sentence, the author knows that "precept and practice" are here combined, and he looks with confidence to his readers affirming them to be judiciously so, well knowing they can appreciate the really practical and useful, without the additional guarantee of the Author's name.

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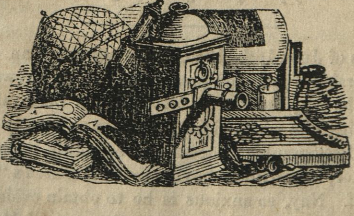
the purpose of holding out a pecuniary inducement for the infringement of his patent.

For the benefit of our readers, we will give an extract from this said advertisement:—"The exercise of the invention within England or the colonies, whether for public or private use, by any person not duly licensed, being an undoubted infringement upon the rights of the patentee, Mr. Beard will feel it imperative (the more so by the recent judgment of the Vice-Chancellor) to take immediate proceedings both in equity and at law against any person he may discover so infringing, and *information with necessary proofs relating thereto will be liberally rewarded.*"

London, July 1845.



THE DAGUERREOTYPE PROCESS.

CHAPTER I.

NOW we shall proceed to describe, in due order, the various photographic processes; and above all things, we wish to impress on the mind of the experimenter the necessity which exists for extreme care in every stage of the manipulation; we cannot lay down a *royal road* to acquire an art which involves the most delicate chemical changes—requiring the most patient perseverance to surmount the difficulties which surround it—and more than ordinary caution in selecting materials for use.

The entire process is comprised in the nine distinct operations, which we shall endeavour to explain as simply as possible, at the same time entering into all necessary detail.

1. Cleaning and polishing the plate.
2. Applying the coating of iodine.
3. Subjecting the plate to the vapours of bromine-water, or other accelerating substances.
4. Exposing the plate in the camera.
5. Subjecting the plate to the action of mercury.
6. Depriving the plate of its sensitive coating in the hyposulphite solution.
7. Washing the plate in pure distilled water, and drying it over a spirit-lamp.
8. Fixing the image, with solution of the chloride of gold.
9. Washing the plate with distilled water, and drying over a spirit-lamp.

We must once more impress upon our readers the necessity of proceeding with patience through each different operation, which, after a little practice, will be found very easy, but which, if not attended to, failure will inevitably be the result.

THE CLEANING PROCESS.

Cleaning the Plate, &c.—Be careful in selecting good plates to begin with: the French are very inferior; the best are the Soho-manufactured plates; and should have a strong metallic lustre, without specks; and the slightest trace of copper should cause any plate to be rejected. A slight line or scratch is no obstacle to obtaining a fine impression, provided always the scratches do not reach the copper; and care must be taken, when operating for a portrait, to place the head upon the part of the plate which is free from imperfections. The articles employed in the cleaning operation are cotton-wool, calcined tripoli, prepared lampblack, olive oil, nitric acid diluted with about sixteen parts of water, and cotton velvet buff. As it is a principal object in cleaning the plate to obtain a surface of silver perfectly pure, care must be taken that the articles used for that purpose are free from impurities, and that the plates should not be prepared in any place where there may exist vapours arising from acids, volatile oils, iodine, bromine, &c. It is, therefore, recommended, as a necessary precaution in the former respect, that the cotton-wool should, previous to its being soaked, for about an hour, in a weak solution of ammonia (hartshorn), then washed in clean water, and dried before the fire, by which means it will be effectually purified from any greasy or or other noxious substance. The calcined tripoli should be reduced to an impalpable powder, and preserved for use in a small muslin bag, which should be placed in a box, so as to preclude the possibility of the slightest admixture of dust with the tripoli powder. The lampblack should be prepared by rendering it red hot, in a crucible, till vapours cease to arise from it; the crucible should then be removed from the fire, and closely covered up until it has cooled, when the lampblack should be reduced to a fine powder, in a mortar, and preserved for use in the same manner as the tripoli.

The Soho plates, as sent out by Mr. Egerton, 1, Temple-street, White-friars, are so highly polished that they require but little doing to them to render them fit for immediate use; the very best polishing process and one that will never find fail, is obtained by using a small lathe. We have a circular block of wood, well covered with a piece of fine blanket, over which the velvet is stretched very tight, screwed on to the headstock spindle, against which we press the plate, held in a *steelholder*, moving it slightly backwards and forwards upon the lathe *rest*, keeping the velvet well dusted with the prepared charcoal, or, what is better, prepared charcoal with a very small quantity of the finest rouge mixed with it.

The velvet should previously be freed from its gum and grease by

steeping it for an hour in boiling water, draining and drying it without touching it with the fingers.

We make use of the usual shaped handbuff to give the plate its final polish, dust a little of the prepared lampblack on the velvet, and briskly polish, holding the plate, if a small one, on the ends of the fingers of the left hand, and using the buff with the right; if a large plate, place it face downwards on the rubber, moving the plate up and down by means of the fingers, with a slight degree of pressure, taking care that for portraits the movement should not be in the direction of the face, but across it; and it is also best for this last polish to be given in a rather dark room, or by the light of a candle, as the clear daylight affects the bright surface of the silver, injuring its sensibility.

On examining the polished plate from a certain angle it will present a black appearance, and, if every particle of dust and tripoli is not removed (by a soft camel-hair brush or cotton wool) from its surface previous to subjecting the plate to the fumes of iodine, black specks will subsequently be discernible on it.

It is worthy of remark that the elevation of temperature produced by the buff causes the plate to become iodized much sooner, and its combination with the surface is thereby rendered more perfect.

If the plate be one that has been previously used, it should be placed, silver side upwards, upon a piece of clean white paper, and shake a small quantity of the tropoli over it; a few drops of olive oil should then be applied, and with a knot of the cotton and a light hand proceed to clean the plate by a series of circular movements, equally over its surface, adding more tripoli as required. The time usually expended for producing a good surface is about ten minutes. It should then be heated over a spirit-lamp for a short time, taking a fresh pledget of wool, and, shaking more tripoli over the plate, gradually wipe off the oil, using a fresh piece of cotton as required: when the whole of the oil is apparently removed the plate ought to be heated over a spirit-lamp till small white spots are observed to form on the surface; it may then be allowed to cool: when cold, apply, by means of a piece of cotton-wool, a few drops of the dilute nitric acid over the plate, which will immediately indicate if it has been sufficiently heated by its flowing easily over its surface, without running into distinct globules, which it would otherwise do; if the acid wets the surface easily, dust a little tripoli over it, and with a fresh piece of cotton-wool dry the acid off in the same manner as you did the oil, but, if the acid does not adhere to the plate, it will require to be rubbed with the tripoli for a little time longer before drying it off.

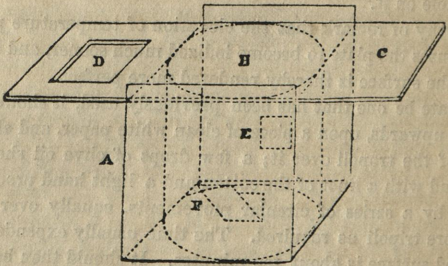
We have also found finely-levigated rotten-stone equally effective,

although much cheaper than tripoli. It is necessary that the operator should always remember to finish the plate with the velvet buff, well dusted with the prepared charcoal and rouge. Before quitting the cleaning process, it may be as well here to reiterate that everything done in this respect should tend to the one important object of finally leaving the plate *chemically clean*, and with as pure a surface of polished silver for the iodine to combine with as it is possible to obtain.

The second operation is that of

THE IODIZING PROCESS.

Iodizing of the Plate.—To effect this we use a glass pan, enclosed in a square box, with a piece of plate glass double the length of the pan to slide over the top, in the one half side of which an aperture is cut, capable of admitting a small wooden frame, having a narrow groove just to receive the plate, and prevent it from falling through. The accompanying small diagram will, however, best explain the construction of the iodizing-box:—



A represents the square box, containing a round glass pan *B*, with ground edges, upon the top of which slides the plate glass cover *C*, with an aperture *D*, to receive the grooved frame upon which the plate to be iodized rests. *E* is a small hole of two inches square, cut in the wooden box, corresponding with one made in a panel of the dark room, through which the light is admitted and received upon the piece of looking-glass at *F*, placed at a convenient angle, so as to embrace the plate undergoing the iodizing process and the patch of white light admitted from the opposite side of the box.

The practical utility of this arrangement for the iodizing box or pan will be readily perceived. The white reflected light, and the plate undergoing its changes, being at once presented to the eye by means of the small piece of looking-glass, the same colour can always be obtained upon the plate

and the process stopped at the precise moment of time. The construction of this box also effectually precludes an escape of the fumes of the iodine from the box itself, which we have before demonstrated, has occasionde a greater number of failures than any other cause of non-success. Indeed the photographic experimentalist cannot be "over careful" in the selection, and so forth, of the apartment in which his plates are to be prepared, inasmuch as damp or fresh paint, and a variety of other apparently very trivial causes, will affect the surface of the preparing plate.

The most unphilosophical observer of nature must be cognizant of the well-known fact that, when we expose to a warmer air any cold body, the humidity contained in the former becomes condensed; and to this cause we may attribute the difficulty experienced by the photographist when operating in any atmosphere affected by moisture, frequently the case in that of an ordinary room, but more especially at this season of the year.

The vapour arising, *even at the slightest variation of temperature*, between the surface of a body and the surrounding air, contains in suspension a non-volatile substance, which subsequently becomes what might be called the atmospheric deposit; for, so soon as an equal temperature is established between the air and the surface of that body, the humid vapour which had condensed upon it then becomes volatile, and, depositing as a sediment that which it previously held in suspension, again mixes with the air, and is again saturated with that impure substance for a subsequent deposit. It is quite evident that this moist coating is *very* injurious. Thus, if you breathe several times on the plate, when first taken out of the camera, the mercurial vapour will not then "bring out" the image. In order, therefore, to paralyse this baneful effect as much as possible, the temperature of the workroom must remain at about 60 deg. Fahrenheit, and the plate may be kept even higher than that of the air which surrounds it during each of the operations. Leaving this slight, but not, as we think, unnecessary, digression from our main subject, we will now proceed with our

Directions for Iodizing.—Insert the polished plate in the groove, pushing the glass cover sufficiently to place the plate directly over the iodine covering the bottom of the glass pan. Allow the plate to remain until the golden yellow colour is obtained; then draw back the cover, take out the plate, and transfer it quickly to the accelerating pan, in which it should continue from two seconds to a minute, to be determined by the strength of the mixture (which we shall more fully describe presently). The colour should now be slightly deepened, and, the roseate hue just beginning to appear, the plate retransferred to the iodizing pan, where the

colour can be deliberately observed by comparison with the white reflected light. The plate must be permitted to remain in this position until the colour is again slightly changed—now to a beautiful damask-rose tint, which should appear uniformly all over the surface of the plate. It must then be quickly removed to the black slide-box of the camera, and is ready for immediate use. If, however, it is carefully excluded from light and air, the peculiar sensitiveness of the plate will be little impaired, although it remain unemployed three or four hours; but it cannot be relied on after a much longer period. Some, indeed, have asserted that the plate is rendered *more sensitive* by being prepared the previous day: this, however, is an absurdity. We have repeatedly tried the effect, and have invariably been confirmed in our view by the result. In hot summer weather, indeed, even after one hour, we cannot, with any degree of certainty, use the plate without first exposing it to the iodine for a second. The pictures produced by the above directions have their deep shades of the blackest and best description, and the whites very clearly and distinctly brought out. The process possesses the advantage also of giving an extremely sensitive coating to the plate. To give your pictures that softness and *creaminess* (if we may so express it) of appearance that some admire, it will be necessary to deepen the colour. In the first iodizing process, proceed at once to the rose colour, over the accelerating substance get the damask rose, and in the last iodizing bring it to the *steel-blue* colour. Some prefer operating without putting the plate the second time over the iodine, supposing it rendered less sensitive by so doing, and they immediately transfer it from the accelerating liquid to the dark box of the camera; but we have found so much uncertainty in this method that we cannot recommend it, although we must say that occasionally we have seen a fine picture obtained by such means.

It may not be amiss here to point out the best means of accustoming the eye to the instantaneous appreciation of the beautiful gradations of colour that the plate necessarily undergoes in the process of iodizing. Spread a small quantity of soap, dissolved in spirits of wine, upon a piece of common flint glass. Breathe upon this through a piece of glass tubeing, when a succession of prismatic coloured rings will appear. In like manner, as is the case with thin laminæ of air, all transparent bodies deposited in thin layers reflect colours which vary in degrees according to their strata. We may, therefore, assume as a general law that the deposition of the iodine upon the plate must conform to the following order, which it will be seen has some relation to the prismatic succession of colours :—A *pale straw* colour, a *yellow;* a dark *yellow* or *orange,* a rose colour, more or less dark in tint, or red violet; steel *blue,* and *indigo;* and,

lastly, *green*. After obtaining this last-named colour, the plate re-assumes a light yellow tint, and continues to pass successively a second time (with some slight alterations) through all the above-enumerated shades. But if the process is allowed to pass beyond the steel *blue* of the first gradation the plate must be removed, and its surface re-cleaned and polished; for it will have been rendered almost insensible to the action of light in the camera; and, even should a picture be obtained on such a plate, it will appear very dull and defective.

THE ACCELERATING PROCESS.

* A pan precisely similar to that which we have already described as to be used in the iodizing may properly be employed for the *accelerating* liquid. The time required to conduct this portion of the process with success will vary, according to the strength of the mixture in great part, from five seconds to a minute. The object to be attained is the colour which we have previously indicated as necessary; and one trial will readily enable the operator to determine the exact period requisite, in the first instance, to effect this object. It will be found, however, that after a few hours the accelerating mixture will become gradually weaker, and, therefore, it will be necessary to increase in proportion the time of subjecting the plate to its influence.

One thing must carefully be avoided—the getting *too much of the accelerative* upon the plate. We have ourselves been excessively annoyed by failures proceeding from this cause, although by having the plate under the eye the colour will always determine when sufficient has been deposited, so that by a little precautionary attention this annoyance seldom need occur.

We next come to consider the different solutions made use of as an *accelerator*. The first and, perhaps, the one more generally adopted is a solution of bromine. To prepare this we put into a bottle of distilled water an excess of bromine, which, being shaken together for some time, will become a *saturated solution* of bromine. One drachm of this to eight ounces of water will be sufficient to pour into the pan at any one time. The colour it should present would be a bright yellow.

The second article is a solution of chloride of bromine. This is to be made by putting into a retort some chloride of lime upon which sufficient sulphuric acid is poured to cover it. The beak of the retort must be previously inserted into a vehicle containing a solution of bromine; luting

* These pans, neatly fitted, may be had of Mr. Egerton before referred to. In fact, all his apparatus is of the best and latest improvement.

will be required to prevent the escape of the chlorine gas, which, being very deleterious, should on no account be inhaled by the operator. One or two drachms are to be employed to about eight ounces of distilled water, so that the mixture may appear of a bright yellow colour in the pan. But the mixture we more particularly recommend was prepared by a Mr. Wolcott (to whom we subsequently refer).*

This mixture cannot be said to have a "fair trial" when used in a pot, having a *cover* which has to be *lifted* off, instead of being provided with the previously recommended *sliding* cover. Cold weather, as our experience testifies, is most unfavourable to this part of the process; the combination of the iodine with the silver is then very tedious and imperfect, and the most careful employment of the *accelerator* will not then prevent that from attacking the silver, instead of quickening and combining with the iodine. The temperature of the apartment ought not therefore to be lower than 60°—*cold* and damp being equally deleterious. The mixture is prepared for use by stirring, wth a glass rod, about thirty or forty drops in half a pint of water, and allowing it to stand for an hour previous to exposing the plate over it.

An exposure of the iodized plate for about five seconds over this fluid will be sufficient, and the pictures produced by it are unequalled in brilliancy and cleanness of appearance; but the principal advantage to be derived from its employment we consider to be the extreme sensibility it induces, and the consequent rapidity with which the operation may be conducted upon the plates in the camera—the critical moment of the daguerreotype. We are convinced that there is nothing in use at all equal to it.

Hitherto the operation of iodizing has been described as of so delicate a nature that it was thought absolutely necessary to perform it in a totally darkened room. We are certain, from practical experience, however, that it may be conducted in an ordinary room, or even out in the open air, with this precaution only, that, if under a powerful light, before being quite ready to transfer into the dark box, it will but require removal into a shaded place, and to be preserved from *direct* contact with the rays of light.† It is very useful to be acquainted with this fact, as by some accident we may get the plate exposed, or the object may move after the focus of the camera has been for too brief a period directed to it. On

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* May be had of Mr. Egerton.

† We are led to believe that the plate is rendered more sensitive by being examined. and the colour noticed in the broad daylight, after its exposure to the sensitive mixture, always taking the precaution to place it for a second or two over the iodine in the dark room.

such occasions some persons have repeated all the tedious processes of cleaning, polishing, and iodizing, instead of which it is merely necessary to place the plate for two or three seconds over the iodine, when it will be rendered again in a fit state, and the operator again will be ready to proceed with a hope of being more successful.

We have been informed that some gentleman has laid claim to this as a recent discovery of his own. This claim is most absurd, inasmuch as very many persons who *constantly* have been engaged in the art have long been aware of the means of thus *restoring* the plate. It was a knowledge of this fact, indeed, and a little consideration of what other purpose it might be rendered available to, that led a very intelligent and scientific machinist (to whom the photographic art is much indebted, and whose death at the end of last year we record with much regret), Mr. Wolcott, an American, to apply for a patent for a process whereby the gradations of light and shade shall generally be rendered (as he describes it) "more true to nature, and which shall prevent the picture from being as much injured from any error in the time of its exposure to the action of the light in making the impression as it otherwise would be."

The following is an account of the operation:—

"When it is supposed that the plate has been sufficiently long exposed to the action of the light to produce the picture, if it was immediately exposed to the vapour of mercury, instead of arresting the operation, the light is allowed to act a longer time on the plate; the plate is then removed and exposed to the vapour of iodine, bromine, chlorine, or a mixture of any of them, or to any other vapour or vapours that shall have the effect of lessening the deposit of the mercury when the plate is afterwards exposed to it. And if the more volatile substances, such as iodine, bromine, or chlorine, are used, they should be very much diluted with water or otherwise; in using iodine, for instance, one part of a saturated solution in water, mixed with 200 parts more of water, will generally be found sufficiently strong: whichever substance is used it should be put into a vessel with a sliding cover, extending so far beyond the side of the vessel as to have an opening in the part beyond of nearly the size of the plate, with a rebate large enough for the plate to go into and nearly through the cover. When the plate is placed in the cover it may be slid over the vessel without allowing the vapour to escape, thus ensuring great regularity in successive operations; otherwise the vessel may be covered with a porous earthenware or other cover, which would allow the vapour to pass through it and act on the plate, which should be brought very near to its upper surface. If the vapour is applied through the cover it should be much stronger. In the case of iodine being used, it

may be put in in the form of crystals. As the proper time of the plate's exposure to vapour, after the impression is made, will be varied so much by the extra time that the light has been allowed to act on the plate, by the strength of the vapour, by the closeness of the vessel, by temperature, and by other circumstances, no exact time of exposure can be stated. It is recommended, first, to get an impression which is known to be overdone, and expose it for a short time to the vapour, and then to the mercury. If the picture when formed is still found to be overdone, the next impression tried (being as much overdone as the last) must be exposed longer to the vapour, or the vapour must be made stronger; by this means a few experiments will give the proper time of exposure, which will serve as a guide for all future operations. If the impression is found to be entirely or too much obliterated in the trial, it shows that the vapour is too strong, or the exposure continued too long. The vapour of iodine is recommended as being the most convenient in practice. The extra time of exposure of the plate to the action of the light may be from one quarter longer to several times as long, according to the nature of the object to be copied: thus, if it is a living object, it will not do to increase the time so much on account of the risk of moving: and in cases where the extremes of light and shade are very great, a much longer time should be used, that the lower lights may not be obliterated by the application of the vapour. Wolcott and Johnson's patent, therefore embraces the exposing photographic plates after the impression is made by the light to any vapour that shall prevent the adhesion of as much mercury to the plate in its after exposure to the vapour of mercury as would have adhered if such previous exposure to vapour had not taken place."

Mr. Shaw recently delivered a lecture at the Royal Institution, "upon some photographic phenomena, being original investigations pursued by him for the purpose of determining some of the conditions which either accelerate or retard the decomposition by light of the salts of silver generally." Mr. Shaw did not communicate any novel information, but he confirmed our views as regards the very small quantity of bromine or chlorine necessary to communicate the greatest degree of sensitiveness to the iodized plate. Mr. Shaw errs, however, when he affirms that after removing the plate from the camera, and exposing it to the vapour of iodine, bromine, or chlorine, *however largely diluted, the* nascent *picture is totally obliterated.* Surely when the Royal Institution lecturer ventured on such on assertion as this he must have been ignorant of Mr. Wolcott's experiments and patent, as above described by us. Most certainly some of the specimens we have seen produced, according to Wolcott's directions, have been of a very superior character, especially when objects

with much *white*, and greatly liable to *solarize*, have been introduced into the picture. Mr. Shaw's experiments led him—as our own did us long since—to the important practical conclusion that the plate need not be longer prepared in the *dark*; but that the sun's light may be fearlessly permitted to fall on it, merely taking the precaution to expose it for an instant to the vapour of bromine or iodine before placing it in the dark box in which it is conveyed to the camera.

Mr. Shaw then states that *pure iodine of silver is not, as is generally supposed, sensitive to light:* it only becomes so when one of the substances used in its combinations *is in excess.* Our own views and results are clearly confirmed in Mr. Shaw's continued experiments on chloride of silver by light; and, as they may prove of great service to our readers, we shall append them:—

"The chloride used was obtained from the nitrate of silver and hydrochloric acid. This salt, having been spread on slips of glass, was secured in glass tubes containing an atmosphere of the gas selected for experiment. The tube was then exposed to daylight, and the consequent darkening of the chloride observed. These investigations led Mr. Shaw to the interesting discovery that chloride of silver, after having been darkened by light, when placed in the dark for two or three hours, reassumes its original whiteness, the chlorine combining under these circumstances with the reduced metal. On being again submitted to daylight, the chloride was again darkened, and again bleached by being placed in the dark; and Mr. Shaw proved that this alternate effect might be repeated indefinitely without diminishing the sensitiveness of the salt. From this curious property of chloride of silver, Mr. Shaw was led to the construction of a photometer. In the course of his researches, Mr. Shaw arrived at another important discovery. He ascertained that some gases and vapours have a specific action on the chemical agency of light without reference to their colours. He observed that rays of light passing through a stratum of bromine had more influence on the chloride of silver than when they passed through an equal stratum of chlorine, notwithstanding the far deeper colour of the former gas. Mr. Shaw concluded by describing another photometer, which, being constantly exposed to light, exhibits, by the change produced in it, the relative intensity of the light at the time of the observation. This instrument consists of a wedge-shaped glass vessel, filled with chlorine, and furnished with a long strip of glass, in the middle of which is a band of chloride of silver, the strip of glass being of an uniform grey colour. When this instrument is exposed to light, the darkening commences on the lower end of the band of chloride of silver, and gradually progresses upwards until the effect of the

light is wholly counteracted by the retarding power of the gas through which it passes, and its contact with the salt. Mr. Shaw expressed his opinion that, by observations made on this instrument at regular intervals, a curve might be deduced, indicating the varying intensity of th light throughout the day."

EXPOSING THE PLATE IN THE CAMERA.

We have now arrived at that stage of the process in which the *prepared plate* is to be *exposed* to the action of light in the *camera*. This instrument being fixed firmly on some convenient plane surface, opposite the object of which a copy is desired, its focus must be so carefully adjusted as to allow a perfectly clear and distinct image to be presented on the piece of ground glass, which, of course, should be placed in exactly the same position as the plate is to occupy, the *ground* side of the glass corresponding with the prepared surface of the plate when in use. The desired focus obtained, the light may then be shut off, the ground-glass slide withdrawn, and the slide containing the plate introduced in its stead. The camera may, after this, be opened, and the light allowed to fall upon the plate through the lens. The time requisite for the remaining of the plate in the camera mainly depends on the intensity of light acting upon the object to be produced on its surface; the season of the year, the time of day, the brightness or clearness of the atmosphere, are, of course, to be regarded, and the *colour* of the *object* itself must also be taken into account, since all *colours* are not equally photographic. For instance, yellows, vermilion, and green, have scarcely any action upon the sensitive plate, whereas blues, violets, and lakes have a very energetic one.

The photographic intensity very materially decreases in proportion as the sun approaches the horizon. Thus from eleven to one o'clock a mere fraction of a second will suffice to produce a picture (a landscape or edifice) in the open air, with a short focus lens, whereas at five or six o'clock in the evening from five to ten seconds will be occupied in producing the same effect.

All this seems, at first sight, very embarrasing; but, in reality, the difficulty can be readily overcome by making a few careful experiments, to become acquainted with the working powers of the apparatus used. When, indeed, an operator has acquired some experience, conjoined with a perfect knowledge of his instrument, he will be enabled readily to determine, without fear of failure, the time during which the plate ought to remain in the camera.

The following are some of the indications by which the operator will know whether the plate has remained too long or too short a time in the

camera:—The exposure will have lasted too long, and the impression be completely *burnt up* or *solarized*, when all the objects reproduced are apparent, but with an inverse intensity to that which they had in nature; that is to say, the whites have become blueish, and the parts which should be black approximate more or less to white. If the plate has not been subjected long enough to the action of light, the impression will be vague, its outlines faintly marked, and the details either indistinct or not at all apparent.

So many conditions are requisite to a successful operation, that, indeed, it might be said that failure is the rule, and success the exception. The operator has constantly to overcome new difficulties, and the greatest is, perhaps, the want of power to appreciate the amount of operating rays existing at every moment. No photometer can be constructed; for the acting rays are not always in the same ratio to the intensity of light. It is true that, if it were possible to measure the comparative quantity of blue, yellow, and red lights, at all times, then it would be of considerable assistance in judging of the amount of photogenic light. But even this test would not be sufficient, for the acting rays are not strictly identical with the blue rays. Still to be able to ascertain that there were no yellow or red vapours in the atmosphere, making, as it were, screens of those colours between the sun and the object, would be, no doubt, an important assistance.

It is to the influence of these vapours that the difference found by operators in various climates is due, which difference seemed at first irrational, but which can now easily be explained.

When the daguerreotype was first discovered, it was expected that southern climates would be more favourable than northern for the process, and that, in countries where the sun constantly shines, the operation would be considerably shorter. This has not been proved to be the fact, and the following reason may be given for such an apparent anomaly. Light is more intense in the northern latitudes up to a certain degree, on account of its being reflected in all directions by the clouds disseminated in the atmosphere; whilst in the drier climates the open sky, instead of reflecting light, absorbs a great quantity of it. Of course, in speaking of clouds, it cannot be meant that a completely covered sky is more favourable than a sky without any clouds, for in this case the sun is entirely obscured. But still there are days when, although the disk of the sun is not seen from any part of the horizon, the thin clouds allow a much more considerable quantity of photogenic rays to be diffused and retained in the lower strata of the atmosphere than when there are no clouds, and that by some imperceptible vapours the light has a yellow or red tint.

There is a curious fact which would seem to corroborate the argument in favour of greater intensity of light in northern climates. It is known that, by a provision of nature, all races of men are constitutionally adapted to the climates in which they are destined to live, that the inhabitants of the tropics can bear a much higher temperature than the inhabitants of the north. May it not be the same for light? The eyes of the inhabitants of the cloudy and snowy countries are adapted to bear a stronger light than those living in the south. In the course of my daguerreotype experience, I have observed that there is a comparatively greater number of Englishmen, than of Frenchmen, Spaniards, and Italians, capable of sitting for their portraits in a strong light, without being much incommoded. If this fact is correct, such a provision of nature would prove that generally light is more intense in the northern climates, and that it decreases gradually towards the equator.

It was at first expected that the climate of England, and countries similarly situated, would be unsuitable to the daguerreotype operation; nevertheless, it has turned out that this is one of the most favourable climates for the practice of the process.

There is another curious fact connected with the photogenic operation, which is, that on the summits of high mountains the action of light upon the plate is not so intense as in the lower regions. A clever operator was sent two years ago into Italy to take daguerreotype views of the most interesting spots of that country. After having visited Rome, Florence, Naples, Venice, and other towns, and succeeded in producing a beautiful and curious collection, he wished, in crossing the Alps on his journey home, to obtain some views of the glaciers, and other Alpine scenes; but, what was his surprise in finding that he could not obtain in one hour, and one hour and a half, in full sunshine, an image of these snowy mountains, having the same degree of force and distinctness as views which he had produced in less than fifteen minutes in the lower countries which he had just visited. The skill of this operator was great; he tried several times, and always with the same difficulty, and at length he abandoned the idea of bringing with him a perfect specimen.

The cause of this fact may be ascribed to the reason given before, that a sky without clouds absorbs a great quantity of light, and that upon high mountains the rarity of the atmosphere would occasion a certain loss of light. But it remains to be ascertained to what degree the light is absorbed, or otherwise affected by the variation in the density of the air at great elevation above the surface of the earth.

It has been found that that part of the spectrum which gives the most light (the yellow ray), will not produce chemical change. Under the

influence of the brilliant light of equtorial climes it has only been with the greatest difficulty that photographic pictures could be produced, owing to the excess of the yellow rays over the blue in the solar beams of those regions. If we interpose between any object and the sun a chrome yellow glass, although it will be most brilliantly illuminated, and throw a beautiful image in the focus of the camera, it will be found impossible to copy it, even by the most sensitive processes, in many hours.

An explanation of these remarkable effects has been attempted, on the hypothesis that the principle producing the remarkable chemical changes, to which we have been referring, is not light, but some power associated with it, which does not affect the eye or produce colour. It would appear, from experiments which have been described by Mr. Hunt, that we can separate, to a certain extent, these influences one from the other by coloured media—and in the experiment above quoted we see that powerful chemical action may be exerted quite independent of Light.

TAKING PORTRAITS.

Portraits are taken with great rapidity in the open air; from five to twenty seconds being usually sufficient, under a clear sky. A Voigtlander lens is best for portraiture, and for views also—no English lens being at all comparable, as we believe, with the Voigtlander for inducing beauty of detail, correct delineation, or, indeed, rapidity of operation.

The position of the camera will, of course, be regulated by circumstances; but, generally speaking, the instrument should be placed nearly on a level with the face. Care must be taken to keep the whole of that portion of the person appearing in the plate as much as possible in the same plane; otherwise any projecting limb—a hand or a leg, for instance—will not be in a correct focus, and consequently be greatly magnified or otherwise represented out of proportion. The direct rays of the sun are best avoided; and, to effect this, the person whose portrait is to be taken should be seated under a canopy of white calico, with a screen of similar material on either side, so as to equalise or diffuse the light as much as possible, leaving the near side of the subject rather more illuminated than the other, in order to produce a pleasing effect of light and shade in the picture, due attention being also paid to position, arrangement of attire, and so forth, with a view to *artistic effect.*

The stiff, formal, and anything but natural or pleasing expression of the daguerreotype pictures, generally exhibited in the metropolis, plainly indicate that those pictures (?) are the productions of individuals whom we must assume to be wholly ignorant of the simplest rules of art, using the term as signifying something more than the mere mechanical hand-

ling of given materials. Often are badly-painted backgrounds introduced, and these are frequently so stupidly managed as to distract attention from what should be the main feature, and the entire picture is thus rendered repulsive to the eye of a person of the slightest taste. The more, indeed, that we see of photographic monstrocities, fathered by individuals who may have forsaken the tradesman's calling for the daguerreotype—knowing, perhaps, little of, and caring, perhaps, less for, the art itself than for the profit attached to the exercise of a monopoly under a patent right—the more we are convinced that the process will attain higher perfection, and consequently be rendered worthier of popularity, in the hands of the amateur cultivating the art from a love of its exceeding beauty and sensible of its many inherent attractions, than from its remaining under the sole control of persons with "vested rights." The amateur, possessing more talent, possibly, in the ordering of a picture, will more certainly bestow requisite time and attention than those may be able to do, to whom we refer as now bringing the newly-dicovered art into the market.

A dark drab-colour stuff forms an excellent back-ground. A table, books, vases of flowers, &c., may be introduced with discrimination; but much *white* should be carefully avoided. These hints being duly attended to, we may anticipate comparative perfection in the representation of the more prominent objects, joined to great precision in the details, with an admirable gradation of shade, which may render the photographic image a masterpiece of art or nature, or both conjointly, when the effects of which it is capable are considered.

VIEWS.

The points from which buildings or views can be taken with the best advantage, vary so greatly, that the operator must be left pretty much to his own discretion, in choosing a position. As a general rule in taking a building, monuments, &c., it is advisable to place the camera at a distance of about twice its greatest dimensions, and, if practicable, at about one-third its height. If the whole of the building or buildings be not in the same plane, select the most important portion to be most clearly defined, or take several views, in each of which certain points are brought out more distinctly.] [If an old and new building are to be introduced in the same picture, which should, if possible, be avoided, a black screen or handkerchief, or some other opaque body should be placed over the lens for a moment or two, so as to cut off the rays of light reflected from the brighter portions of the object, the position of which may be previously observed on the ground glass. The same precaution should be taken

when the sky is very blue, or strongly illuminated by the sun. The best time for taking views, is undoubtedly the earlier part of the day.

ENGRAVINGS, DRAWINGS, &c. may be copied very beautifully with a little care; the whole of the model being in the same plane, there is little difficulty in producing a good effect. The object to be copied must be placed in a good light, taking care to have every part equally illuminated. To secure sharpness, the model is placed in the open daylight, and a small diaphram introduced before the lens to reduce the aperture and cut-off part of the external light.

MACHINERY, STATUARY, AND ARTICLES OF VERTU, require to be arranged in suitable positions, so that the light may fall upon the object most effectively.

THE MERCURIALIZING PROCESS.

In withdrawing the plate from the camera an exposure of it to the external light should be avoided, and it should immediately be conveyed to the mercurializing box, and there be submitted to the vapour of mercury, in the cup at the bottom of the box, about two ounces of quicksilver, tied up in a piece of chamois leather or linen rag, of course being first placed. The plate is to be placed in the proper position, and the mercury in the cup gradually heated by means of a small spirit lamp standing under it until the thermometer indicates about 140 or 150 degrees of heat. It will be necessary to continue this heat from seven to about fifteen minutes, or even longer, to develop the picture, which may be examined from time to time by the aid of an artificial light. This operation is generally rendered more certain by the mercury being heated, before the plate is introduced, to about 120 degrees, in order that any damp air that may have collected in the box may be expelled. Indeed, this will shorten the time required in the conduct of this portion of the process. Should it so happen that no outline be visible in about three or four minutes, it may arise from one of the following causes—either the picture has been removed too soon from the influence of light in the camera, some atmospheric or chemical vapour floating in the room has affected it, or the mercury may not have been sufficiently heated. It must, nevertheless, be borne in mind that the details are usually much better developed when the picture has been brought out slowly, and with a degree of heat never exceeding 160 Fahr. Attention must be paid to keeping the mercury-box free from dust, and any mercurial particles adhering to the sides and top must be previously well removed by the aid of a stiff brush. A small *painter's tool* will answer the purpose best. The reason for this precaution is, that otherwise some small globules of

mercury might be detached and fly upon the face of a good picture on the slightest movement being accidentally given to the box.

We find in this part of the process that those parts of iodized silver plate, upon which the light has acted with most power, receive, in the exposure to the vapours of mercury, the largest quantity of that vapour over their surfaces, and the gradations of light are marked very beautifully by the thickness of these mercurial films.

The character and *tone* of the picture almost exclusively depends upon the mixture employed, as may be seen by inspecting those produced by Beard and Claudet. The one uses a chloride, and the other a euchloride of bromine. Claudet also applies the vapour of the chlorine and bromine separately to the iodized plate. Beard, for some time used two mixtures he called A and B, with iodine stirred together in one pot, and when operating in the open air this answers very well.

The A mixture is a chloride of iodine formed by distilling with a great heat—one part of iodine, and three of chlorate of potass. The B mixture is iodic acid, made by passing into a flask, containing iodine—an excess of gas arising from a mixture of oxide of manganese and sulphuric acid. But the very best pictures taken at Beard's was with the Wolcott's mixture, as we have been assured.

It may be worthy of observation that the image on plates may be completely obliterated by rubbing, but it may be again restored by placing it in a tolerably strong solution of iodine in water. Some very curious results have been obtained by operating on silvered plates, with iodine in various ways. A silvered plate, with some leaves placed upon it and pressed close with a glass, was immersed in a solution of iodine in water, and in this state exposed to the light. An ioduret of silver was rapidly formed and blackened; this blackened coating was dissolved off, and another formed. Thus successive layers of the salt were formed and removed, until at the expiration of an hour all the silver was gone from the exposed parts of the plate. Upon removing the leaves, it was found that a most beautiful impression of them remained on the copper, and they were of a rich green colour.

THE HYPOSULPHITE BATH.

When the picture is fully developed, and the whites clearly brought out (*without the small white pinheads of mercury appearing over the surface*), the plate is to be removed from the influence of the mercury, and allowed to cool a short time before plunging in the hyposulphite of soda bath, previously prepared by dissolving about two drachms of the crystalised salt in half a pint of distilled water. Here it will be suffered to remain a few minutes until all the iodine be removed from the plate, the operator

agitating the solution to facilitate the object now in view. From hence it is to be taken and well washed in a basin of clean water, and then convey it quickly into the washing and drying apparatus. This consists of a *small filter*, or barrel of distilled water, with a stopcock, which allows the water to flow into an enclosed copper trough, passing off at a spout. The flow of water is then turned off, and the spirit lamp—with a large flame—applied, which, quickly bringing the water in the copper trough to near the boiling point, admits of the plate—by the heat thus given being withdrawn—by slowly pushing up a small handle, connected with the wire frame on which the plate rests in the interior of the trough, and blowing from the mouth upon the plate as it appears to drive off in vapour the adhering globules of water, thus entirely preventing the spotting so frequently observed when hot water has simply been poured over the plate as usually recommended.*

The hyposulphite crystals should be very clear and bright, the brown lumps being rejected; and it should be carefully ascertained that they contain no excess of sulphur, or, in other words, the operator must not obtain a *sulphate* instead of a *sulphite*, or he will have the mortification of observing numerous blueish and milky spots appear in the subsequent process, which, in a short time, will completely spoil a picture.

FIXING THE PICTURE.

Fixing the Picture.—If this is intended to be effected immediately, it will be sufficient, upon withdrawing the plate from the hyposulphite solution, to sluice it abundantly with water, and place it on the fixing-stand—a small upright stand, with adjusting screws, to allow of the plate resting on a perfect level. Then so much of the solution of the chloride of gold as the plate will contain should be poured upon it. The spirit-lamp is then to be held under all parts of the plate successively until it becomes thickly studded with small bubbles, and the image begins first to assume a dark appearance. In one or two minutes afterwards it acquires a great degree of intensity. The lamp must now be removed, and the plate left for a few minutes until it has become somewhat cool. The liquid being then poured off, the plate should be put into the washing apparatus, and dried with the spirit-lamp as before directed.

In the operation we have just described the following phenomena have taken place:—Silver has been dissolved, and gold has been precipitated upon the silver, and also upon the mercury, but with different results. The silver, which by its polish forms the dark parts of the picture, is in

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* This apparatus may be obtained fitted up very cheaply of Mr. Egerton, 1, Temple Street.

some degree browned by the thin coating of gold which covers it, whence results an increased intensity in the black parts. The mercury, on the contrary, which, under the form of infinitely small globules, forms the whites, increases in strength and brilliancy by its amalgamation with the gold, whence results a greater degree of fixity, and a remarkable augmentation in the light parts of the image.

The solution of the chloride of gold is prepared in the following manner :—Take seven grains of the chloride of gold, weighed very quickly in glass scales, as it is an extremely deliquescent salt; dissolve in a quarter of a pint of distilled water, and twenty-one grains of the hyposulphite of soda dissolve in another quarter of a pint of distilled water; then gradually pour the solution of gold into that of the soda, stirring it all the while with a glass rod. The mixture, which is at first of a slightly yellow colour, soon becomes perfectly limpid.

Should this solution change colour, or have deposited any brown precipitate at any time, it must be immediately rejected, as it will be no longer fit for use; to avoid which as much as possible, it will be better to keep it perfectly excluded from light, and only a small quantity should be mixed at any one time.

There has been recently introduced from Paris by Mr. Egerton a white salt of gold, that is not so liable to spoil, or so difficult to manage as the chloride of gold, and the result of the use of which upon the picture is equally brilliant.

It has also been tried, and we believe with success, to fix the image in a silver bath, prepared by dissolving cyanide of silver and cyanide of potassium in distilled water. This is the process, adopted:—Upon removing the picture from the mercury, it should be plunged into this silver bath, in which it should remain for a few seconds until the sensitive coating is dissolved. A galvanic current being then established in the usual way with the battery, in eight or ten seconds the picture will be fixed.

Its advantages are stated to be—1st, that it gives great brilliancy to the lights, and the solarized parts become very white; 2nd, that, silver being a photogenic metal, the plates may be easily reprepared for use by rubbing with dry tripoli; 3rd, that if, over a picture, when taken from the mercury, or after being fixed by silver, concentrated hyposulphite of soda solution should be poured, and the liquid brought nearly to a boiling point, the picture gradually assumes the richest tints, passing successively from yellow to red, and from red to blue; the zinc pole determines these colours in the cold at the points near it, pictures already fixed by chloride of gold giving the richest colours.

This process is not very unlike one proposed by Professor Page, of New York. In a course of experiments made by him to determine the effects of oxidation upon the surface of photographic pictures, that gentleman arrived at some very beautiful results, and adopted the following method for fixing, strengthening, and colouring his impressions.

After taking and washing his picture in the usual manner, he plunged it in a bath of *cupreous cyanide of copper*, and by galvanic agency a very light deposit of copper was precipitated upon it, only just sufficient to change the colour of the plate; then washed very carefully with distilled water, and heated over a spirit-lamp until the light parts assume a pearly transparent appearance. He also found that, according to the depth of oxidation produced upon the surface, various colours were the result; and one remarkable effect is the great hardening of surface, and that it is as little liable to change as the fixing by gold.

For landscapes we know that it has a pleasing effect; and, by adopting some of the recent inventions for stopping out the deposit of copper, the green colour may be made to appear stronger wherever desired. In some pictures a curious variety of colours is obtained, owing to the varying thickness of the deposit of copper, which is governed by the thickness of the deposit of mercury forming the picture. To succeed well in the fixing and in the production of the pearly appearance, the picture in the first instance should be carried as far as possible without solarization, the solution of the hyposulphite of soda employed should especially be pure and free from the traces of *sulphur*, and the plate should be carefully washed with distilled water both before and after it receives the deposit of copper.

Mr. Fox Talbot also describes a process for colouring the pictures by the battery, not very unlike the process adopted by Mr. Page. It is as follows:—

A smooth surface of steel, platina, or other suitable metal, is coated with an extremely thin layer of silver. The silver is then made sensitive to light, by the methods now well known, and a photographic image is received upon it. The plate with the image is then placed in a horizontal position, and a solution of acetate of lead in water, is poured upon it. A galvanic current is then made to pass through the plate and the solution, which causes a coloured film to precipitate upon the plate.

Also, a method of obtaining very thin silver plates or surfaces, for the purpose of economy in the processes of photography in which such are used, and also for the greater convenience of transport in travelling. For this purpose he precipitates on a polished metal plate, a thin layer of copper by the galvanic process, now well known by the name of electrotype. He then cements or glues a sheet of paper or card to the back of

this layer of copper, and when it is dry, removes the paper with the layer of copper adhering. This copper is then silvered by dipping it into any suitable solution of silver.

PROCESS OF COLOURING.

In our opinion colouring a beautifully delineated photographic picture is akin to "painting the lily white," or daubing an exquisite line engraving all over with gaudy colours. Possibly, however, the reader's taste does not quite conform with that of our own, in this particular, and he may fancy that a slight colouring renders his picture yet more attractive to the eye. We, therefore, present him with such directions as will best enable him to gratify his "liking" in this respect:—

Dissolve two or three grains of gum arabic in a wine glass of water, and, subsequently, cast in a small quantity of carmine or other finely powdered colour. Set aside the glass until the coarse particles have subsided (as they will do in a few minutes) at the bottom of the vessel; then pour the particles remaining in suspension through a sheet of white filtering paper, and let this mixture continue undisturbed until it has become thoroughly drained and dry, when it is "fit for use." When this colouring mixture is required for use a small portion should be rubbed off with a fine camel's hair pencil, and delicately stencilled on that part of the picture's surface intended to be coloured. A few delicate touches of this prepared carmine will suffice to colour the lips and cheeks of the portrait. The admixture of carmine, with two thirds of equally fine powdered *raw* seinna forms a very natural looking flesh colour, and another tint is obtained by using *burnt* seinna; but for sallow and dark complexions, generally, the carmine had better be dispensed with, and the seinna only used. Prussian blue, cobalt, and ultra-marine are the best blue colours, and either mixed with an equal quantity of chrome yellow, produces an excellent *green*. Chrome yellow can also be used alone, but we have frequently found that pictures will not readily *take* either a yellow or green, if not laid on slightly moistened with spirit of wine. Ready prepared shells of gold and silver are obtained at any colour vendors, but neither will adhere to the plate if not moistened.

This mode of colouring is so far preferable to any other yet suggested, that it admits of the easy and clean removal of *over colouring*, by the simple employment of a clean brush—an article which it is advisable to have constantly within hand reach. If, therefore, the complexion is painted too rubicund, or the attire, and so forth, be spotted by droppings of flesh colour, either may be speedily removed by the brush or a small pair of bellows—the portrait being thus preserved from spoiling, and the artist

enabled to "put on" or "take off" the colour until he has produced the desired effect.

All the colours should be prepared in the same mode as that prescribed for carmine, and they should be kept very dry on the paper, so as to be always ready for use. The highly polished and dark appearance of the material precludes the effective employment of almost every other colour than those above enumerated—these can be purchased, in the form of an almost impalpable powder, of any artist's colourman.

THE MULTIPLICATION OF PICTURES.

It has been urged as a very great objection that Daguerreotype pictures do not admit, as the Calotype's, of being re-produced or copied; but many improvements have suggested themselves to remove this difficulty to the multiplication of a good or valuable proof. Perhaps the best yet pointed out, was the last of Wolcott's inventions, relating to a camera, in which photographic pictures on polished plates may be copied by the scattered light from the surface of the plate, that portion of the light which is reflected from the polished surface at the same angle at which the incident rays fall (according to the laws of reflection of polished surfaces), being prevented from entering the lenses of the camera; and in which camera pictures that are distorted in the perspective, by reason of the camera in which it was taken making an improper angle with the horizon, either accidentally, or in order to take in parts of a view which otherwise would not be seen, may be copied in true perspective.

If the glasses are placed at equal distances from the picture and the plate on which they are to be copied, the copy will be equal in size to the picture to be copied, and at any other distances, that will be the largest which is farthest from the glasses. In all these changes the focal distance must be carefully preserved, by changing the position of the plate on which the copy is to be made; as the *sum* of the focal distances becomes greater as the difference between the two focii increases.

To understand this arrangement for correcting the perspective, it must be borne in mind, that in taking a photographic picture, as the end of the camera nearest any object is more elevated, the upper part of the object will be more contracted in the picture than the under part; and that if the same end of the camera is depressed, the reverse will take place. Thus, a row of columns, instead of being all perpendicular, would, in the one case, appear falling together, and in the other, to fall outwards. As it often happens in consequence of some obstruction, that distance enough from the object cannot be had to bring all the parts within the field, unless the camera is thus elevated or depressed, a pic-

ture in true perspective could never be made, unless the evil could be corrected in the copy, as may be done.

The operation is as follows :—Place the picture, and a plate on which the copy is to be made, in a frame, and in such manner, that the parts which are perpendicular in the object shall be horizontal in the frame, then bring the end of the picture, in which the perspective is contracted, a little nearer the glasses, by causing it to turn on its axis ; then, supposing the copy to be of the size of the original, turn the end of the plate on which the copy is to be made to the same angle to the glasses as the picture is, and in such direction, that the ends, both of the picture and the plate for the copy which are nearest the glasses, shall both be on the same side of the box. Now it will be seen, that by this arrangement the parts of the picture which are nearest to the glasses will be copied on to that part of the plate which is farthest from the glasses, and thereby be copied larger than if the plates were parallel ; and that those parts of the picture which are farthest from the glasses will be copied on that part of the plate which is nearest to the glasses, and thus be copied smaller than if they were parallel, thus correcting the perspective in the copy. The proper angle to place the picture and plate, according to the amount of distortion, can soon be determined by a few experiments. As in the picture and plate, those parts which are nearest the glasses in the one, are farthest in the other ; the focal distance is very nearly preserved. The sizes of the plates or pictures, with regard to the focal distance, should be such, that when they are adjusted to the proper focal distance, either for pictures and plates of different sizes or for those of equal size, the angles subtended from the glasses to the ends of the plate, be not more than thirty degrees. For the convex lenses, common plate-glass may be used ; the concave should be of the heavy flint, of a specific gravity of about 3·5; and for a focal distance of about 7·7 inches, the following proportions will perform very well. The side of the concave glass next to the aperture, is plane and distant 79-100 of an inch ; the other side of the concave, and also that side of the convex which is next it, are made to a radius of 1 78-100; the other side of the convex is made to a radius of 2 62-100 inches. The thickness of the concave in the middle is 6-100 inch, and that of the convex is 56-100 inch, diameters about $1\frac{1}{4}$ inch. If the pictures that are to be copied, have been taken in a camera that did not contain a reflector, they would be reversed, but the copy would be correct. A metallic plate has been mentioned as the surface on which the pictures are to be copied, but any material may be used that is properly prepared to receive an impression, by light. The edge of the box should be so high, that a ray of light

passing into the box close to that part, and falling on to the polished surface of the picture close to its upper edge, shall, when reflected, be thrown below the glasses. It having been found that the clearest blacks in a picture are produced when the polish of the plate has been finished by straight strokes in that direction, which will be horizontal in the picture, it becomes necessary in copying pictures formed on plates so polished, to place them in the box in such a manner that the lines of the polish shall be perpendicular; and in all cases, in whatever direction the lines of polish in the picture are, they must be placed perpendicularly in copying. In cases where the polish has been made in curved, or otherwise than in parallel straight lines, that position should be chosen in which the largest portion of the lines will be perpendicular, or most nearly so; or, at all events, in which such will be the case in the most important parts of the picture.

This position of the lines will cause the light which falls on the inclined edges of the lines (the lines of the polish being only so many minute furrows) to be reflected to that part of the box which is below the glasses; whereas if the light was allowed to fall at right angles to the lines a large portion of it would be reflected from the lines into the glasses. Every part of the inside of the box between the picture and the partition, should be lined with black cotton velvet, or otherwise blackened so as to prevent any injurious reflection of light. By these means, if the polished surface of the picture were viewed from the place occupied by the glasses no object or light from objects bright enough to interfere with the operation would be perceived in it, and, of course, there would not be much light to act on the plate or other material on which the picture is to be copied, and thereby injure the copy, which it is only intended should be made by scattering lights from the rough surface produced by the adhesion of mercury, of which the picture is essentially composed, being painted on the polished black ground of the plate.

His invention consists then in the mode of constructing cameras, containing a chamber for the picture to be copied, and so constructed, that if the picture were viewed from the place occupied by the glasses, no object, or light from objects bright enough to prevent a distinct view of all the parts of the picture, could be seen in the polished surface of the picture. And also the mode of making cameras whereby a copy in true perspective may be obtained from a picture not in perspective.

THE REPRODUCTION OF PICTURES BY THE ELECTROTYPE.

The plate must first be entirely divested of all traces of hyposulphite. and is *indispensable* that it should be perfectly fixed by the chloride of gold.

In general, operators are in a hurry to see the progress of the process. We advise them to moderate that eagerness which is frequently the cause of failure. They should always wait a few minutes before taking the plate out of the bath; and, each time that it is done, care must be taken not to leave it long in contact with the air, as a few minutes would suffice to oxydize the surface to such a degree as to hinder the next deposite from adhering to the first.

When the metallic coating is judged to be of sufficient thickness—and, in this case, that of a stout card suffices—the plate should be rinsed copiously in water, and then dried either with saw-dust or blotting-paper. If you wish to preserve on the plate the beautitul rosy hue of the mother-of-pearl opal, which the deposite should leave on its being taken out of the bath, hasten the drying of it, after passing it once through the water, by wetting it with spirits of wine, which you also dry up with blotting-paper.

The separation of the deposite from the plate may be attended with an accident which spoils them both. It often happens that a small drop of liquid remains unperceived under the wax which covers the borders of the plate, and that, at the instant when you lift up the deposite with the blade of a knife, this drop works itself into the capillary space thus formed, and wets the deposite and the plate, which are infallibly stained if the liquid contains any remaining particles of the sulphate of copper.

The most secure process for separating the two plates consists, when the deposite is not too thick, in cutting with a pair of strong scissors all round the edges of the two plates, which then separate with the greatest facility.

The affinity of oxygen for copper being much greater than for silver, the counter-proof must be withdrawn as soon as possible from the concontact of the air, by placing it in a skeleton frame; and above all, the greatest care must be taken not to touch its surface. It is also necessary to observe the nicest precaution in preventing all dust or other foreign substances from lodging on the surface of the plate, otherwise the copy would be found disfigured with their corresponding traces.

Having thus explained the most essential conditions to be observed, we will now enter into some further details of the operation. Lay hold of the silvered plate by one of its sides, or, if a small plate, by one of its angles, and keep that part free from oxydation, in order to attach it to the connecting wire of the trough, to which the positive pole (zinc) of the battery is joined, and the whole is held fast with a binding-screw.

The back of the plate is then covered with a coating of varnish, com-

posed of one-third of essence of turpentine and two-thirds of beeswax, or simply of beeswax alone, in order to avoid a useless deposite of copper. Care must be taken that this coating of varnish, which should be applied hot, should be of a certain thickness, and should not interpose between the plate and the connecting wire of the precipitating trough, or it would interrupt the metallic contact necessary to the success of the operation.

The sulphate of copper solution must be carefully filtered, and it must be saturated in cold water.*

When all is prepared, put the positive electrode (a copper plate which dissolves in the trough) in connexion with the negative pole of the battery (carbon), and immerse it in the bath; establish also a connexion between the proof to be reproduced and the other pole (zinc), and when firmly attached by means of one or more binding-screws, it must be immersed in the bath, when it will immediately become covered with copper.

The expense consists, therefore, only in the value of the copper deposited; and when it is considered that, with so very small an outlay, you may be able, after one or two experiments, to reproduce and multiply, without any risk of failure, the finest photographic impressions (which are always very much prized), with a very warm tone, and an admirable degree of perfection; when you reflect that the same small apparatus may serve for a number of other applications, one is really surprised that it should not be more generally adopted.

ENGRAVING PHOTOGRAPHIC PLATES.

It was found that the parts over which the mercury had been deposited were deeply etched by the iodine, and a very important practical advantage has been taken of this remarkable peculiarity, by the recent attempts at etching the pictures. Professor Groves was the first to point out a mode by the aid of an acid and a powerful voltaic current, and we believe he succeeded in producing some pleasing results; but a better plan has been lately patented by Claudet, and is as follows:—

1. A mixed acid, composed of water, nitric acid, nitrate of potassa, and common salt, in certain proportions, being poured upon a Daguerreotype picture attacks the pure silver, forming a chloride of that metal, and does not affect the white parts, which are produced by the mercury; but this

* In order to have a solution always ready, it will be well to keep it in a large glass-bottle; it will be known that it is sufficiently saturated, when after having shaken it several times, the liquid ceases to dissolve the few crystals of sulphate of copper which remain at the bottom in excess.

action does not continue long. Then, by a treatment with ammonia (ammonia containing already chloride of silver in solution is preferable for this operation), the chloride of silver is dissolved, and washed off, and the metal being again in its naked state, or cleansed from the chloride, it can be attacked afresh by the same acid. This acid acts better warm than cold.

2. As all metallic surfaces are soon covered, when exposed to the atmosphere, with greasy or resinous matters, it is necessary, in order that the action of the acid upon the pure silver should have its full effect, for the surface to be perfectly purified; this is effected by the employment of alcohol and caustic potash.

3. When a Daguerreotype picture is submitted to the effect of a boiling concentrated solution of caustic potash, before being attacked by the acid, the state of its surface is so modified that the acid spares or leaves, in the parts which it attacks, a great number of points, which form the grain of the engraving.

4. When the effect of the acid is not sufficient, or in other words, if it has not bitten deep enough, the effect is increased by the following process:—Ink the plate as copper-plate printers do, but with a siccative ink; when the ink is sufficiently dry, polish the white parts of the plate, and gild it by the electrotype process; then wash it with warm caustic potash, and bite in with an acid, which will not attack the gold, but only the metal in those parts which, having been protected by the ink, have not received the coating of gold. By these means the engraving is completed, as by the action of the acid alone it is not generally bitten in deep enough.

5. To protect the plate from the effects of wear, produced by the operation of printing, the following process is employed:—The surface of the plate is covered with a very thin coating of copper, by means of the electrotype process, before submitting it to the operation of printing; and when that pellicle or coating of copper begins to show signs of wear, it must be removed altogether, by plunging the plate in ammonia, or in a weak acid which, by electro-chemical action, will dissolve the copper, without affecting the metal under it; the plate is then coppered again, by the same means, and is then ready for producing a further number of impressions. This re-coating operation may be repeated as many times as may be required. The following is the description of the whole process, which is divided into two parts, consisting of a preparatory and finishing process:—

Preparatory Engraving.—For this operation, which is the most delicate, it is necessary to have, 1. A saturated solution of caustic potash. 2. Pure nitric acid at 36° of the areometer of Beaumé (spec. grav. 1·333.)

3. A solution of nitrite of potassa, composed of 100 parts of water and 5 parts of nitrite, by weight. 4. A solution of common salt, composed of water 100 parts, and salt 10 parts, by weight. 5. A weak solution of ammoniacal chloride of silver, with an excess of ammonia. The ammoniacal chloride of silver must be diluted with 15 or 20 parts of pure water. In the description of the process, this solution will be called ammoniacal chloride of silver. 6. A weak solution of ammonia, containing 4 or 5 thousandths of liquid ammonia. This solution will be called ammoniacal water. 7. A weak solution of caustic potash, containing 4 or 5 thousandths of the saturated solution, which will be called alkaline water. 8. A solution composed of water 4 parts, saturated solution of potash 2 parts, alcohol 1 part, all in volume. This solution will be called alcoholised potash. 9. Acidulated water, composed of water 100 parts, and nitric acid 2 parts, in volume. Besides, it is necessary to have three capsulæ or dishes, made of porcelain, large enough to contain the plate, and covered with an air-tight piece of ground plate-glass, and two or three more capsulæ which do not require to be covered; two or three glass funnels, to wash the plate; and two or three glass holders, in the shape of a spoon or shovel, by which the plate is supported when put in and taken out of the solution, without touching it with the fingers.

The Daguerreotype plate is submitted to the engraving process, after having been washed in the hyposulphite of soda, and afterwards in distilled water.

First process for biting in or engraving the plate.—The following solutions must be put in the capsulæ, in sufficient quantity, so as to entirely cover the plate:—1. Acidulated water. 2. Alkaline water. 3. Alcoholised potash, in covered capsulæ. 4. Caustic potash, in covered capsulæ. 5. Distilled water.

The plate being put upon the glass holder or spoon, is plunged in the acidulated water, and agitated during a few seconds, then put into a glass funnel, and washed with distilled water. It is taken again with the glass spoon, and plunged in the capsula containing alcoholised potash. This capsula is covered with its glass cover, and then heated, by means of a spirit-lamp, to about 144° Fahrenheit. The plate must remain in the capsula half an hour, during which the solution is heated now and then, and agitated. During that time, the following acid solution, which will be called *normal acid*, must be prepared; it is composed as follows:—Water 600 parts, nitric acid 45 parts, solution of nitrite of potassa 12 parts, solution of common salt 45 parts. These proportions are in volume. The normal acid must be poured in a capsula, covered with its glass cover, and a sufficient quantity must be kept in the bottle.

When the plate has been immersed in the alcoholised potash during half an hour, it is taken out of the solution by means of the glass holder, and immediately plunged in the alkaline water, and agitated pretty strongly; from thence it is put in distilled water. (A)

This being done, the plate is plunged in the acidulated water, and moved about therein for a few seconds: it is then put into the normal acid. When the plate has been immersed a few seconds in the acid, it is taken out by means of the glass holder, taking care to keep it as much as possible covered with the solution, and it is immediately placed horizontally upon a stand, and as much acid as the plate can hold is poured upon it from the bottle; it is then heated with a spirit-lamp, but without attaining the boiling point. During this operation it is better to stir or move about the acid on the plate by pumping it, and ejecting it again, by means of a pipette or glass syringe; after two or three minutes the acid is thrown away, the plate is put in the glass funnel, and there well washed with water, and afterwards with distilled water. (B)

Then, without letting the plate dry, it is put upon the fingers of the left hand, and with the right hand some ammoniacal chloride of silver, which is moved about the surface by balancing the hand, is poured upon it; the solution is renewed until the chloride, formed by the action of the acid, is dissolved; the plate is then washed by pouring upon it a large quantity of ammoniacal water, and afterwards some distilled water. (C)

Without allowing the plate to dry, it is then put in the caustic potash, and the capsula being placed upon the stand, the potash is heated up to the boiling point; it is then left to cool (D); and beginning again the operations described from A to D, a second biting is obtained; and by repeating again the operations described in A and B, a third biting is produced. The plate is then dried; in this state the black parts of the plate are filled with chloride of silver.

The plate is then polished until the white parts are perfectly pure and bright. This polishing is done with cotton and "pounce" (pumice stone); afterwards, the chloride of silver; filling the black parts, is cleansed by the means described in B and C. The plate is then dried; but before drying, it is well to rub the plate slightly with the finger, in order to take off from the black parts any remains of an insoluble body which generally remain on it. The preparatory engraving is then finished, and the plate has the appearance of a very delicate aqua-tint engraved plate, not very deeply bitten in.

Nevertheless, if the operation has been well managed, and has been successful, it is deep enough to allow the printing of a considerable number of copies.

Note.—Sometimes, instead of treating the plate with the boiling potash in the capsula, a similar result may be obtained by placing the plate upon the stand, covering it with the solution, and heating it by means of a spirit-lamp, until, by evaporation, the potash becomes in a state of ignited fusion. By this means the grain is finer, but the white parts are more liable to be attacked.

Last operation of biting in.—This operation requires some of the reagents before named, and also,

1. A siccative ink, made of linseed oil, rendered very siccative by boiling it sufficiently with litharge; it may be thickened with calcined lamp-black.

2. An electrotype apparatus, and some solutions fit to gild and copper the plate.

Means of operating.—The plate must be inked as copper-plate printers do, taking care to clean off the white parts more perfectly than usual; the plate is then to be placed in a room sufficiently warm, until the ink is well dried, which requires more or less time, according to the nature of the oil employed. The drying of the oil may be hastened by heating the plate upon the stand with the lamp, but the slow process is more perfect and certain.

When the ink is well dried, the white parts are cleaned again by polishing the plate with cotton and pounce, or any other polishing powder: a ball of cotton, or any other matter, covered with a thin piece of caoutchouc or skin, can be used for this purpose. When polished, the plate is ready to receive the electro-chemical coating of gold, which will protect the white parts.

Gilding.—The gilding is obtained by any of the various processes of electrotyping which are known. The only indispensable condition is, that the surface obtained by the precipitation must not be liable to be attacked by any weak acid; a solution answering this purpose is made of ten parts (by weight) of ferrocyanide of potassium, one part of chloride of gold, and 1000 parts of water, used with a galvanic battery. During the gilding the plate must be turned in several positions, in order to regulate the metallic deposit. In some cases the gilding may be made more perfect, if the plate is covered with a thin coating of mercury before being put in the gilding solution.

When the plate is gilded, it must be treated with the boiling caustic potash, by the process already indicated for the preparatory engraving, in order to cleanse it from all the dried oil or ink which fits the hollows. The plate is then washed and dried, and when the oil employed has been thickened with the lamp-black, the surface of the plate is rubbed with

crumb of bread, in order to cleanse and take off the black remaining; then, the white parts being covered and protected by a varnish not liable to be attacked, and the black parts being uncovered and clean, the plate can be bitten in by aquafortis, according to the ordinary process used by engravers.

This operation must be done upon the stand, and not by immersing the plate in the solution.

Before this last biting-in, if the preparatory engraving has not succeeded well, and the plate still wants a sufficient grain, it can be given by the various processes of aquatint engraving.

Before submitting the plate to the operation of printing, in order to insure an unlimited number of copies, it is necessary, as before stated, to protect it by a slight coating of copper, which is obtained by the electrotype process; otherwise the printing would soon wear the plate. This coating must be kept very thin, lest the fineness of the engraving, and the polish of the white parts, should be destroyed. In this state the plate can be delivered to the printer.

After a certain number of impressions have been obtained, it will be perceived that the coating of copper is worn in some places; then, this coating must be removed, and a fresh one applied in its place. For this purpose, the plate must be purified and cleansed by warm potash, and plunged in a weak acid composed as follows:—Water, 600 parts; nitric acid, 50 parts; nitrous acid of engravers, 5 parts; all in volume. This acid will dissolve the coating of copper, and the plate being coppered again by the same means as before, may be again submitted to the operation of printing; and as nothing can prevent the success of a repetition of the same operation, any number of impressions may be obtained. The coating of copper can also be removed by caustic ammonia.

The Daguerreotype plates engraved by this process, which constitute the present invention, consist,—

First,—in the discovery and employment of certain properties of a mixture composed of nitric acid, nitrous acid, and hydrochloric acid, in determined or fixed proportions. The two last-mentioned acids may be employed either in a free state, or combined with alkaline or other basis. This mixed acid has the property of biting the pure silver which forms the black parts of the Daguerreotype picture, without attacking the white parts formed by the amalgam of mercury. The result of the action of the biting is to form on the black parts of the picture an insoluble chloride of silver; and this chloride of silver which when formed stops the action of the acid, is dissolved by ammonia, which allows the biting to continue.

Secondly,—in the discovery of certain properties of a warm solution of caustic potash, and in the employment of the said solution, by which the mercury forming the picture is better and deeper amalgamated with the silver under it, so that many imperceptible points of the amalgam are effected in such a manner that the acid has no action upon them.

Thirdly,—in the discovery and employment of a process which produces a grain favourable to the engraving, by which the biting on the plate is rendered deeper. This is effected by filling the parts engraved with a siccative ink, or any other substance, and then gilding the plate by the electrotype process; the gold is not deposited on the parts protected by the ink. When the plate is gilded, the ink is cleansed by the caustic potash, and the plate may be submitted to the effects of an acid which, does not attack the coating of gold, but bites only on the silver in the parts already engraved by the first operation.

Fourthly,—in the employment of a process by which the plate is protected from the wear of the printing operation. This is effected by covering the plate before printing with a slight coating of copper by the electrotype process, and when the coating begins to wear by printing, it is removed by a weak acid, or by ammonia, which dissolves the copper without affecting the silver under it. The plate is coppered again, and after another printing the same operation is repeated, so that a considerable number of copies may be printed without much injury to the engraving.

We have in our possession an exquisite picture printed on paper from one of these etched plates, and it is, indeed, equal to a very fine mezzotinto, and from this specimen have, no doubt, but that, with a little patient attention, some beautiful results may be obtained.

It was stated at the late meeting of the British association by Mr. Goadby, that Claudet had fully established the successful application of this process to the purposes of illustrating natural history, by copying from nature, and engraving several delicate and difficult dissections of the lower animals, particularly the nervous system of Aplysia and Tritonia (the latter much magnified) and the nutrimental organs *in situ* of a caterpillar.

Captain Ibbetson also employed a similar process for engraving microscopic objects. He exhibited some plates of blood-globules, &c., procured in this way by Dr. Donné, of Paris. It must be observed, to produce a very perfect specimen, that it generally requires to be finished by the hand of the engraver, who has the advantage of a *perfect*, although *faint* picture to work upon.

Tolerable positive pictures have been obtained without mercurializa-

tion, as will be seen in the following experiment by Mr. Hunt. After exposing to light, a prepared photographic plate, it was placed in a vessel, in which chlorine was very slowly forming, from manganese and muriatic acid. In a short time the iodized surface, which had not been exposed sufficiently long to undergo any change of colour, became perfectly black. In this state, it was subjected to light, the effect of which was to whiten the plate, with much rapidity. A few well conducted experiments in a similar way may lead to unlooked-for results.

It is asserted by Mr. Hunt, upon the authority of Dr. Robinson, of Armagh, that lunar light will not act chemically upon the prepared photographic plate; we are at a loss to imagine what Dr. Robinson could have prepared his plates with, as we have repeatedly obtained an image of the moon upon our plates in one minute, and in two, three, and five minutes they have been completely *solarized*; upon an occasion of a plate remaining exposed for half-an-hour, we found that the image had moved over the space of an inch leaving a *solarized* comet-like train, very much *over done* (as it is technically termed) the whole length.

A. M. Martenz, of Paris, states that he has discovered the means of carrying on the daguerreotype process on a gigantic scale. He can, he says, daguerreotype an entire panorama, embracing 150 degrees!! His process consists in curving the metallic plate, and causing the lens which reflects the landscape to turn by clockwork. The lens, in turning, passes over on one side the whole space to be daguerreotyped, and on the other side moves the refracted luminous cone to the plate, to which the objects are successively conveyed.

Mr. Fox Talbot suggested a very curious experiment which we should be glad to hear the result of. He says, "When a ray of solar light is refracted by a prism, and thrown upon a screen, it forms there the very beautiful coloured band known by the name of the solar spectrum. Experiments have found that if this spectrum is thrown upon a sheet of sensitive paper, the violet end of it produces the simple effect: and, what is truly remarkable, a similar effect is produced by certain *invisible rays* which lie beyond the violet, and beyond the limits of the spectrum, and whose existence is only revealed to us by this action which they exert. Now I would propose to separate the invisible rays from the rest, by suffering them to pass into an adjoining apartment through an aperture in a wall or screen of partition. This apartment would thus become filled (we must not call it *illuminated*) with invisible rays, which might be scattered in all directions by a convex lens placed behind the aperture. If there were a number of persons in the room no one would see the other; and yet, nevertheless, if a *camera* were so placed as to point in the

direction in which any one was standing, it would take his portrait and reveal his actions; * * the eye of the camera would see plainly where the human eye would find nothing but darkness." From this we would infer that powerful chemical action may be exerted independent of light. Sir J. Herschel proposed the epithet of *actino-chemistry*, to distinguish this chemical power from the light and heat with which it is associated, and it would indeed appear from the phenomena connected with the *actinic* influence, that we are on the eve of discovering some remarkable truths, which will probably embrace all the changes which occur on the surface of our globe; since photography has taught us how to prepare a metal plate, or a sheet of paper, which shall in a few seconds receive an impression of a *shadow*, to which the permanence of an engraving can be given, and thus we shall be enabled to hand down to future ages a picture of the sunshine of yesterday, or a memorial of the haze of to-day, such are the results of recent investigation.

CHAPTER II.

THE CALOTYPE OR TALBOTYPE.

The art of photography is greatly indebted to Mr. Fox Talbot for its present state of perfection. It must not be forgotten, as we have before pointed out, that Mr. Talbot was the first who succeeded in *fixing* images taken by the camera, and by super-position on paper; and that he has steadily pursued his experiments until the perfection of the calotype has rewarded his perseverance. Some of his recently published productions are for minuteness of detail and beauty very little inferior to those taken on silver plates. Several other inquirers have been labouring in the same field, and the result of their researches has been the extraordinary discovery, that all bodies are constantly undergoing changes under the influence of the solar rays; from the delicately sensitive film which is formed on the silver plate to all the salts of the metals, and even to the metals themselves, or plates of glass or stone, have been found capable of receiving light impressed pictures. A shadow cannot fall upon any solid body without leaving evidence behind it, in the disturbed and undisturbed condition of its molecular arrangement of the parts in light or shade. It is evident, then, that all bodies are capable of photographic disturbance,

and might be used for the production of pictures, did we but know the methods by which the pictures might be developed, for it must be remembered that in all the best photographic processes the images are invisible at first, and we are not without hope that at no very distant time these means may be discovered. We shall now proceed to give, in Mr. Talbot's own words, the very latest improvements he has published for the preparation of the calotype paper. The only apparatus necessary for this purpose are a few wood frames, a trifle smaller than the sheets of paper to be prepared, two or three soft camel's hair brushes, some sheets of white blotting paper, two or three glasses for holding the solutions, and two glass stirring rods.

First Part of the Preparation of the Paper.—I dissolve 100 grains of chrystallized nitrate of silver in six ounces of distilled water; I wash one side of the paper with this solution with a soft camel hair brush, and place a mark upon that side by which to know it again. I dry the paper cautiously at a distant fire, or else I leave it to dry spontaneously in a dark place. Next I dip the paper in a solution of iodide of potassium, containing 500 grains of that salt dissolved in one pint of water. I leave the paper a minute or two in this solution. I then take it out and dip it in water. I then dry it lightly with blotting paper, and finish drying it at a fire, or else I leave it to dry spontaneously. All this process is best done in the evening by candle-light. The paper thus far prepared may be called, for the sake of distinction, iodized paper. This iodized paper is scarcely sensitive to light, but nevertheless it should be kept in a portfolio or some dark place till wanted for use. It does not spoil by keeping any length of time, provided it is kept in a portfolio and not exposed to the light.

Second Part of the Preparation of the Paper.—This second part is best deferred until the paper is wanted for use. When that time is arrived I take a sheet of the iodized paper and wash it with a liquid prepared in the following manner. Dissolve 100 grains of chystallized nitrate of silver in two ounces of distilled water; to this solution add one-sixth of its volume of strong acetic acid; let this mixture be called A; dissolve chrystallized gallic acid in distilled water, as much as it will dissolve (which is a very small quantity); let this solution be called B. When you wish to prepare a sheet of paper for use, mix together the liquids, A and B, in equal volumes. This mixture I shall call by the name of gallo-nitrate of silver. Let no more be mixed than is intended to be used at one time, because the mixture will not keep good for a long period. Then take a sheet of iodized paper and wash it over with this gallo-nitrate of silver with a soft camel hair brush, taking care to wash it on the side

which has been previously marked. This operation should be performed by candle-light. Let the paper rest half a minute, and then dip it into water, then dry it lightly with blotting paper; and lastly, dry it cautiously at a fire, holding it at a considerable distance therefrom. When dry the paper is fit for use; but it is advisable to use it within a few hours after its preparation.

Note, that if it is so used immediately, the last drying may be dispensed with, and the paper may be used moist.

Note 2. Instead of using a solution of gallic acid for the liquid, B, the tincture of galls diluted with water may be used, but it is not so advisable.

Use of the Paper.—The paper thus prepared, and which I name calotype paper, is placed in a camera obscura, so as to receive the image formed in the focus of the lens. Of course the paper must be screened or defended from the light during the time it is being put into the camera. When the camera is properly pointed at the object, this screen is withdrawn, or a pair of internal folding doors are opened, so as to expose the paper for the reception of the image. If the object is very bright, or the time employed is sufficiently long, a sensible image is perceived upon the paper when it is withdrawn from the camera; but when the time is short, or the objects dim, no image whatever is visible upon the paper, which appears entirely blank. Nevertheless it is impressed with an invisible image, and I have discovered the means of causing this image to become visible. This is performed as follows:—I take some gallo-nitrate of silver, prepared in the manner before directed, and with this liquid I wash the paper all over with a soft camel hair brush. I then hold it before a gentle fire, and in a short time (varying from a few seconds to a minute or two) the image begins to appear upon the paper. Those parts of the paper upon which light has acted the most strongly become brown or black, while those parts on which light has not acted remain white. The image continues to strengthen and grow more and more visible during some time; when it appears strong enough the operation should be terminated and the picture fixed.

The Fixing Process.—In order to fix the picture thus obtained I first dip it into water. I then partly dry it with blotting-paper, and then wash it with a solution of bromide of potassium, containing 100 grains of the salt dissolved in eight or ten ounces of water. The picture is then washed with water and then finally dried. Instead of bromide of potassium, a strong solution of common salt may be used, but it is less advisable. The picture thus obtained will have its lights and shades reversed. With respect to the natural objects, viz., the lights of the objects are re-

presented by shades, and *vice versa*. But it is easy from this picture to obtain another, which shall be conformable to nature, viz., in which the lights shall be represented by lights, and the shades by shades. It is only necessary for this purpose to take a second sheet of sensitive calotype paper and place it in close contact with the first, upon which the picture has been formed. A board is put beneath them and a sheet of glass above, and the whole is pressed into close contact by screws. Being then placed in sunshine or daylight for a short time, an image or copy is formed upon the second sheet of paper. This image or copy is often invisible at first, but the image may be made to appear in the same way that has been already stated. But I do not recommend that the copy should be taken on calotype paper; on the contrary, I would advise that it should be taken on common photographic paper. This paper is made by washing good writing paper first with a weak solution of common salt, and next with a solution of nitrate of silver. Since it is well known, having been freely communicated to the public by myself in the year 1839, and that it forms no part of the present invention, I need not describe it here more particularly, although it takes a much longer time to obtain a copy upon this paper than upon calotype paper, yet the tints of the copy are generally more harmonious and agreeable. On whatever paper the copy is taken it should be fixed in the way already described. After a calotype picture has furnished a good many copies it sometimes grows faint, and the subsequent copies are inferior. This may be prevented by means of a process which revives the strength of the calotype pictures. In order to this it is only necessary to wash them by candle-light with gallo-nitrate of silver, and then warm them. This causes all the shades of the picture to darken considerably, while the white parts are unaffected. After this the picture is of course to be fixed a second time. The picture will then yield a second series of copies, and a great number of them may frequently be made.

Note. In the same way in which I have just explained that a faded calotype picture may be revived and restored, it is possible to strengthen and revive photographs which have been made on other descriptions of sensitive photographic paper, but these are inferior in beauty, and moreover the result is less to be depended on, I therefore do not recommend them.

The next part of my invention consists in a mode of obtaining positive photographic pictures, that is to say, photo-graphics, in which the lights of the object are represented by lights, and the shades by shades. I have already described how this may be done by a double process; but I shall now describe the means of doing it by a single process: I take a sheet of

sensitive calotype paper and expose it to daylight, until I perceive a slight but visible discolouration or browning of its surface,—this generally occurs in a few seconds. I then dip the paper into a solution of iodide of potassium, of the same strength as before; viz., 500 grains to one pint of water. This immersion apparently removes the visible impression caused by the light—nevertheless, it does not really remove it; for if the paper were to be now washed with gall-nitrate of silver, it would speedily blacken all over. The paper, when taken out of the iodide of potassium, is dipped in water, and then lightly dried with blotting paper. It is then placed in the focus of a camera obscura, which is pointed at an object. After five or ten minutes the paper is withdrawn and washed with gallo-nitrate of silver, and warmed as before directed. An image will then appear of a positive kind; namely, representing the lights of the objects by lights, and the shades by shades. Engravings may be very well copied in the same way, and positive copies of them obtained at once (reversed, however, from right to left). For this purpose a sheet of calotype paper is taken and held in daylight to darken it, as before mentioned; but for the present purpose it should be more darkened than if it were intended to be used in the camera obscura. The rest of the process is the same. The engraving and the sensitive paper should be pressed into close contact with screws or otherwise, and placed in the sunshine, which generally effects the copy in a minute or two. This copy, if it is not sufficiently distinct, must be rendered visible, or strengthened, with the gallo-nitrate of silver, as before described. I am aware that the use of iodide of potassium for obtaining positive photographs has been recommended by others; and I do not claim it here by itself as a new invention, but only when used in conjunction with the gallo-nitrate of silver; or, when the pictures obtained are rendered visible or strengthened subsequently to their first formation. In order to take portraits from the life, I prefer to use for the object glass of the camera, a lens whose focal length is only three or four times greater than the diameter of the aperture. The person whose portrait is to be taken should be so placed that the head may be as steady as possible, and the camera being then pointed at it, an image is received on the sensitive calotype paper. I prefer to conduct the process in the open air, under a serene sky, but without sunshine: the image is generally obtained in half a minute, or a minute. If sunshine is employed, a sheet of blue glass should be used as a screen to defend the eyes from too much glare, because this glass does not materially weaken the power of the chemical rays to affect the paper. The portrait thus obtained on the calotype paper is a negative one; and from this a positive copy may be obtained in the way already described.

Care must be taken to obtain paper of a very fine and even texture, and perfectly free from all foreign matter in its substance, which would cause blemishes in the picture. The best kind of paper is that called blue wove post, and each sheet, preparatory to its being used, should be carefully examined before a strong light, and those sheets rejected in which any spots or uneven texture is observed.

This calotype paper is so exceedingly sensitive to the influence of light that very beautiful copies of lace, feathers, leaves, pictures, or ancient writing may be made by the light of a common gas-light, or an argand oil lamp. Merely press the article to be copied against a piece of the prepared paper, with a sheet of strong glass and expose them to the light about four or five inches from the flame for the space of two or three minutes.

SIR D. BREWSTER'S IMPROVED METHOD OF TAKING POSITIVE CALOTYPES, OR TALBOTYPES.

In the method now in use the face of the negative Talbotype is placed directly upon the side of the paper which has been brushed over with a solution of nitrate, or ammonia-nitrate, of silver, and which is to receive the positive picture. In strong sunlight the picture is thus taken very quickly ; but there is a roughness in the shades, owing to the formation of black specks, which destroys the softness of the picture, and in portraits gives a disagreeable harshness to the human face. In order to remove this defect, the author first interposed thin plates of glass, with their surfaces sometimes ground and sometimes polished ; but, though the divergency or diffusion of the light, passing through the *negative* picture, produced great softness in the *positive*, yet the outlines were too indistinct, though the Talbotypes looked very well, when placed at a distance. He then tried the effect of interposing a sheet of writing paper, without the water-mark and of uniform texture. The result of this experiment fully answered his expectations. The diffusion of the light thus occasioned shaded off, as it were, all the sharp lines and points, and gave a high degree of softness to the picture. The effect was even improved by interposing *two* sheets of clean paper ; and, with a very bright meridian sun, he found that *three* sheets may be used with advantage. A similar effect may be obtained, in a smaller degree, by placing the *back* of the negative upon the positive paper, so as to cause the light to traverse the thickness of the negative, and this may be combined with one or more sheets of clean paper. This, of course, will be appropriate only with portraits ; and it has the advantage (sometimes required) of making the figure look another way. To those who see the

experiments above described for the first time, the effect is almost magical; and when the negative is removed, we see only a blank sheet of white paper; and our surprise is very great when, upon lifting this sheet, we discover beneath it a perfect picture, which seems as it were to have passed through the opaque and impervious screen.

Mr. Hunt's Ferrotype

Is a very simple and exceedingly good process, easily managed, and worthy the attention of the amateur, we will give it in Mr. Hunt's own words, as all that proceeds from a thoroughly practical man is of value to the learner.

"All the photographic processes with which we are at present acquainted, sufficiently sensitive for the fixation of the images of the camera-obscura,) require the most careful and precise manipulation; consequently, those who are not accustomed to the niceties of experimental pursuits, are frequently annoyed by failures. The following statement will at once show the exceeding simplicity of the new discovery :—

Good letter-paper is first washed over with the following solution :—

A saturated solution of succinic acid,	2 drachms.
Mucilage of gum-arabic	$\frac{1}{2}$ "
Water	$1\frac{1}{2}$ "

When the paper is dry, it is washed over once with an argentine solution, consisting of 1 drachm of nitrate of silver to 1 ounce of distilled water. The paper is allowed to dry in the dark, and it is fit for use. It can be preserved in a portfolio, and at any time employed in the camera. This paper is a pure white, and it retains its colour, which is a great advantage. At present I find it necessary to expose this prepared paper in the camera-obscura for periods, varying with the quantity of sunshine, from two to eight minutes, although, from some results which I have obtained, I am satisfied that, by a nice adjustment of the proportions of the materials, a much shorter exposure will suffice. When the paper is removed from the camera, no trace of a picture is visible. We have then to mix together 1 drachm of a saturated solution of *sulphate of iron*, and 2 or 3 drachms of the *mucilage of gum-arabic*. A wide flat brush, saturated with this solution, is now swept over the face of the paper rapidly and evenly. In a few seconds the dormant images are seen to develope themselves, and with great rapidity a pleasing *negative* photographic picture is produced. The iron solution is to be washed off as soon as the best effect appears, this being done with a soft sponge and clean water. The drawing is then soaked for a short time in water, and may be permanently fixed by being washed over with ammonia, or, perhaps, better with a solution of the hyposulphite of soda, care being taken

that the salt is afterwards well washed out of the paper. From the pictures thus produced, any number of others, correct in position, and in light and shadow, may be produced, by using the same succinated papers in the ordinary way, from five to ten minutes in sunshine producing the desired effect.

The advantages which this process possesses over every other must be, I think, apparent. The papers are prepared in the most simple manner, and may be kept ready by the tourist until required for use. They require no preparation previously to their being placed in the camera, and they can be preserved until a convenient opportunity offers for bringing out the picture, which is done in the most simple manner, with a material which can be anywhere procured.

He has since made a brilliant improvement in the above process, it is as follows :—

Having prepared the paper according to his directions, and submitted it to the action of the sun's rays in the camera, it must be removed and dexterously immersed into a vessel containing a spiritous solution of the essential oils of cassia and cloves ; and as soon as the spirit has penetrated the texture of the paper, which will be in the space of a few moments, it must be taken out, and with the quickness of thought, laid flat on a piece of plate-glass, and kept pressed in that position by means of blotting paper, saturated with the same solution for an hour or two. The result is, a picture beautifully delineated, with brilliant metallic lines of silver, for wherever the nitrate remains unacted upon by the light and other reagents made use of, the oils, (as in the new process for the manufacture of mirrors) throws down the silver in the metallic state.

IODIZED PAPER.

The expense of metallic plates and their inconvenience, particularly to travellers, renders it very desirable that some material, such as paper, might be employed instead of them. Some very tolerable effects may be produced upon silvered paper; but the pictures thus formed, want the fine black surface, which is to contrast with the mercurial vapour, and which forms the chief charm of a good Daguerreotype. Mr. Hunt first pointed out the mode of preparing this paper, he says—

Any of the ordinary photographic papers, will darken by exposure to brown or dark olive colour. Exposed to the vapour of iodine, the paper becomes of a steel blue or violet colour. If subjected to solar influence in this state, mercurial vapour attacks all the parts on which the light has acted, in the same manner as it does the iodized metallic plate, giving a tolerable picture. I also found, that perfectly pure oxide of silver, spread on paper and iodized, was similarly disposed to receive the mer-

curial vapour, after it had been submitted to the sun's rays. The yellow-brown phosphate of silver, was also found to acquire additional sensitiveness under the influence of iodine, and to yield a tolerable picture when exposed to the mercurial fumes.

Papers which were prepared, by first saturating them, with strong solutions of the nitrate of silver, and then exposed to phosphuretted hydrogen gas, until there was a complete revival of the silver over the surface of the paper, were found to be acted upon by iodine, in a similar way to the silver plates themselves, and for most purposes are capable of being substituted for them. The pictures, when the papers are well prepared, are formed as readily as upon the iodized plates, and are not wanting in the beauty of their general effect, or in the delicacy of their minute detail. It unfortunately happens that a considerable degree of risk attends the preparation of the paper by this spontaneous inflammable gas.

Papers prepared in a similar way, substituting the sulphuretted for the phosphuretted hydrogen, are in nearly all respects equal to them. Some difficulties attend the preparation, but, by observing the following directions, papers of a very uniform dark grey surface may be prepared. The paper is first soaked in a solution of the muriate of ammonia, carefully wiped with cotton cloths, and then dried. It is next dipped in a solution of nitrate of silver, dried in the dark, and then carried into a vessel in which sulphuretted hydrogen is slowly forming. When it has darkened to an iron brown, the paper must be passed through water slightly impregnated with chlorine or muriatic acid, and again dried. It is once more dipped into an argentine solution, and when dry, subjected a second time to sulphuration. These papers are best iodized by drawing them slowly over a saturated solution of any hydriodic salt, in which is dissolved a considerable quantity of iodine ; care must be taken that one side only of the paper is wetted. It is then dried near the fire, and subjected in the camera to the solar agency. After mercurialisation, the picture is fixed most effectually by a strong solution of common salt used moderately warm.

If when these drawings are finished, they are placed in a solution of corrosive sublimate, the images entirely disappear, but after a few minutes they are seen, as if by magic, unfolding themselves, and gradually becoming far more beautiful than before—delicate lines, at first invisible or barely seen, are now distinctly marked, and a rare and singular perfection of detail is given to the photograph. The picture is thus restored by the agent which caused it to disappear, and it would appear that the mercury on the paper, is slowly converted into a protochloride ; but the *modus operandi* is not, however, quite evident.

THE CHROMATYPE.

The process is so exceedingly simple, and the resulting pictures of so very pleasing a character, that, although it is not sufficiently sensitive for use in the camera-obscura, it will be found of the greatest value for copying botanical specimens, engravings, or the like.

Good writing-paper is washed over with sulphate of copper in solution, the strength of which is not of much importance. About one drachm to an ounce of water is preferred ; when dry it is washed over with a moderately strong, but not saturated, solution of the bichromate of potash. The paper, when dry, is fit for use, and it may be, I believe, kept for any length of time in a portfolio, without its sensibility being in the least impaired.

When exposed to the sunshine, the first change is to a dull brown; and if checked in this stage of the process, we have a *negative* picture; but if the action of light is continued, the browning gives way, and we have a a *positive* yellow picture on a white ground. In either case, if the paper, when removed from the sunshine, is washed over with a solution of nitrate of silver, a very beautiful positive picture results. In practice it will be found advantageous to allow the bleaching action to go on to some extent: the picture resulting from this, will be clearer and more defined than that which is procured when the action is checked at the brown stage. To fix these pictures, it is necessary to remove the excess of nitrate of silver, which is done by washing in pure water. If the water contains any muriates, the picture suffers; and long soaking in such water entirely destroys it: or if a few grains of common salt are added to the water, the apparent destruction is very rapid. The picture is, however, capable of restoration ; all that is necessary being to expose it to the sunshine for ten minutes or a quarter of an hour, when it revives ; but instead of being of a red colour, it becomes lilac, the shades of colour depending upon the quantity of salt used to decompose the chromate of silver. After this exposure, no fixing is required, the continued action of light only still further improving the pictures.

Modification of the Chromatype.—If to a solution of the sulphate of copper we add a solution of the chromate of potash—the neutral salt—a brown precipitate falls very copiously, which is a true chromate of copper. If this precipitate, after being well washed, is added to water rendered tolerably acid by sulphuric acid, it is dissolved, and a dichromatic solution is formed, which is, when spread upon paper, a pure yellow. A very short exposure of the papers, washed with this solution, is quite sufficient to discharge all the yellow from the paper, and give to it a perfect whiteness. If an engraving is to be copied, we proceed in the usual

manner; and we may either bring out the picture by placing the paper in a solution of carbonate of soda or potash, by which all the shadows are represented by the chromate of copper; or by washing the paper with the nitrate of silver. It may sometimes happen that, owing to deficient light, the engraving is darkened all over when the silver is applied; this colour, by keeping, is gradually removed, and the lights come out clear and sharp. The little excess of acid in the paper, acts upon the chromate, which has been partially changed, and a pale yellow, instead of a red salt, is formed.

If the chromate of copper is dissolved in ammonia, a beautiful green solution results. If papers are prepared with this solution, they act similarly to those last mentioned. If the pictures prepared as above are washed with ammonia, they are nearly obliterated; but upon exposing them to the air and light, negative pictures of a pale blue colour result.

All the salts of copper, undergo some change under the influence of the solar radiations. The change is not in many cases apparent, but in some it is so. If, however, a solution of any salt of copper is laid over paper, and it be exposed to the sunshine, a change is brought about; and if after it is removed from the light, it is washed with nitrate of silver, the covered portion remains of its original colour, whilst the exposed parts darken very considerably. The following salts afford really interesting pictures:—Sulphate, muriate, nitrate, carbonate, acetate, oxalate, ammonia-oxalate, tartrate, malate, chloride, bromide, and arseniate. We do not doubt but by attention and experiment, some of these may afford very valuable photographic preparations. At all events these results show the immense field of inquiry which is opening before us.

A beautiful variation of the chromatype by Mr. Hunt. A neutral solution of the chloride of gold is mixed with an equal quantity of the bichromate of potash. Paper is washed with this solution, and dried near the fire. On exposing this paper to light, it speedily changes, first to a deep brown, and ultimately to bluish black. If an engraving is superposed, we have a negative copy, blue or brown, upon a yellow ground. If this photograph is placed in clean water, and allowed to remain in it for some hours, very singular changes takes place. The yellow salt is all dissolved out, and those parts of the paper left beautifully white. All the dark portions of the paper become more decided in their character, and accordingly as the solarization has been prolonged, or otherwise, or the light has been more or less intense, we have either *crimson, blue, brown, or deep black, negative photographs* of a most beautiful character.

THE CYANOTYPE.

This name has been applied by Sir John Herschel to the whole class of processes in which cyanogen forms a leading part, with a mixture which may contain equal proportions of ammonia-citrate of iron and ferrosesquicyanate of potash prepare a paper, and impress it with a picture, after which throw it into water, and dry it; a *negative blue* picture will be produced. If this picture is washed with a solution of the protonitrate of mercury, it is in a little time discharged. The mercurial salt being thoroughly washed out, and the paper dried, the picture is susceptible of restoration. If a smooth iron is passed over it somewhat hotter than is used for ironing linen, but not sufficiently so as to scorch the paper, the obliterated picture immediately reappears, not blue, *but brown.* However carefully kept, these photographs fade after a few weeks and disappear. A fresh application of heat restores them to full intensity.

This use of a mercurial salt led Sir John Herschel to devise an improvement on the cyanotype process, which affords much more certain results and more decided pictures. One part by weight of the ammonia-citrate of iron is dissolved in eleven parts of water, and this is mixed with an equal quantity of a saturated cold solution of corrosive sublimate (bichloride of mercury). Before a precipitate has had time to form, the solution is washed over paper (which should have rather a yellowish than a bluish cast) and dried. This paper appears to keep well. It is exposed to light till a faint, but perfectly visible picture is impressed. It is then washed over as rapidly as possible with a broad flat brush dipped in a saturated solution of prussiate of potash, diluted with three times its bulk of gum water, so strong as just to flow freely without adhesion to the lip of the vessel. Care is required to spread this wash with one application, evenly, over every part of the paper. Beautiful pictures are thus produced, which will immediately bear exposure to light tolerably well, but which after a few days will bear strong sunshine uninjured. By long keeping, details which were barely seen at first, come out with continually increasing intensity.

Wash a paper with a solution of the ammonia-citrate of iron and dry it ; then wash it over with a solution of the ferrocyanate of potash ; there is no immediate formation of true prussian blue, but the paper rapidly acquires a deep purple colour. If in this state these papers are exposed to light, they give positive pictures of great sharpness ; but they possess this peculiarity—they darken again spontaneously on exposure to the air in darkness, and are soon obliterated. The paper, however, remains susceptible to light, and capable of receiving other pictures, which fade in turn. If these pictures are washed with ammonia

or its carbonate, they are for a few moments obliterated, but they presently reappear, with *reversed lights and shades.* "In this state they are fixed, and the ammonia, with all that it will dissolve, being removed by washing in water, their colour becomes a pure prussian blue, which deepens much by keeping. If the solutions be mixed, there results a very dark violet-coloured ink, which may be kept uninjured in an opaque bottle, and will readily furnish by a single wash, at a moment's notice, the positive paper in question, which is most sensitive when wet."

Paper simply washed with the ferrosesquicyanuret of potassium, is highly sensitive to light. Exposed to sunshine for about an hour, with an engraving upon it, a beautiful negative photograph is the result These are fixed by soaking in water in which a little sulphate of soda is dissolved, to insure the fixity of the prussian blue deposited. While dry this cyanotype is dove-colour on a greenish yellow ground; after washing, it becomes bright blue on a white ground.

Prepare a paper by washing, first, with a weak solution of ammonia-citrate of iron, one part, by weight, of the salt to twenty parts of water, and, when dry, with a saturated solution of the protonitrate of mercury. When nearly dry expose it for twenty minutes or half an hour to the light, and a faint photograph will result. If it is now wetted with water and held for a few minutes in the sun, every part of the picture becomes visible, each line assuming an inky blackness. Instead of water, the solution of the nitrate of mercury may be used, and it possesses the advantage of giving greater permanence to the picture than when it was excited by water only.

THE CHRYSOTYPE.

"Paper is washed with a moderately concentrated solution of ammonia-citrate of iron, and dried; the strength of the solution being such as to dry into a good yellow colour, and not at all brown. In this state it is ready to receive a photographic image, which may be impressed on it, either from nature in the camera obscura, or from an engraving on a frame in sunshine. The image so impressed, however, is faint, and sometimes hardly perceptible. The moment it is removed from the frame or camera, it must be washed over with a neutral solution of gold, of such strength as to have the colour of sherry wine. Instantly the picture appears, not indeed at once of its full intensity, but darkening with great rapidity up to a certain point, depending on the strength of the solutions used, &c. At this point nothing can surpass the sharpness and perfection of detail of the resulting photograph. To arrest this process, and to fix the picture (so far at least as the agency of *light* is concerned), it is to be thrown into water slightly acidulated with sulphuric acid, and well

soaked, dried, washed with hydrobromate of potash, rinsed, and dried again."

Subsequently the talented discoverer of this process recommended the hydriodate of potash as superior to the hydrobromate as a fixing agent. "As soon as the picture is satisfactorily brought out by the auriferous fluid, it is to be rinsed in spring water, which must be three times renewed. It is then blotted off and dried, after which it is to be washed on both sides with a somewhat weak solution of hydriodate of potash. If there be any free chloride of gold present in the pores of the paper it will be discoloured, the lights passing to a ruddy brown; but they speedily whiten again spontaneously, or at all events on throwing it (after lying a minute or two) into fresh water, in which being again rinsed and dried, it is now perfectly fixed."

If instead of a solution of gold the nitrate of silver is used, the picture is brought out somewhat more slowly, and, as far as my own experience goes, with much less beauty, whether we consider colour or detail.

THE FLUOROTYPE.

This process, which is characterised by its easy manipulation, and by the sensibility of the papers when carefully prepared, consists in the formation of a salt of silver, which must be considered as a fluo-bromide of silver. It is at present somewhat difficult to say, which is the most efficacious manner of proceeding; but the difference, as it regards the sensibility of papers, is so very trifling that this is not of much consequence. The paper may be washed first, with the bromide of potassium, and then with the fluate of soda; or, which will be found on the whole the best plan, the two salts may be united. The strength of the solutions should be as follows :—

Bromide of potassium -	20 grains.
Distilled water - -	1 fluid ounce.
Fluate of soda - -	5 grains.
Distilled water - -	1 fluid ounce.

Mix a small quantity of these solutions together when the papers are to be prepared, and wash the paper once over with the mixture, and when dry, apply nitrate of silver, in solution, 60 grains to an ounce of water. These papers appear to keep for some weeks without injury, and they become impressed with good images in half a minute in the camera. This impression is not sufficiently strong to serve, in the state in which it is taken from the camera, for producing positive pictures, but it may be rendered so, by a secondary process.

The photograph is first soaked in water for a few minutes; it is then

placed upon a slab of porcelain or stone, and a weak solution of the protosulphate of iron applied, which very readily darkens, all the parts on which the light has acted, to a deep brown, and every object is brought out with great sharpness. When the best effect is produced the process must be stopped, or the lights suffer. All that is necessary is to soak the paper in water, and then fix the drawing with hyposulphite of soda. This process admits of numerous modifications.

Paper is prepared with bromide of potassium and nitrate of silver, in such proportions that the nitrate is in very slight excess. When used, it is washed over with a solution of 120 grains of nitrate of silver, and placed wet in the camera. After being exposed for a second or two, the light must be shut off, the camera carried into a dark room, and the paper allowed to dry in the dark. When dry it is placed in the mercurial vapour box; and heat being applied, the mercury is very slowly vaporised. The picture now begins to develope itself, and gradually a most intense photograph results. It often happens that the picture appears at first clouded; but if the paper is carefully placed in the dark, it generally, in the course of a few hours, gets clear. We have often procured most beautiful pictures by this method, after an exposure to solar influence during a second; and moving objects have been well defined, showing the action to be almost instantaneous. Photographs thus procured are best fixed, by soaking the paper in a weak solution of salt in water, and then by brushing the paper over with the hyposulphite of soda. The great difficulty to be overcome in this process, is the annoyance continually arising, from the perfect blackness produced over every part of the paper by the mercurial vapour. Often, when the best result appears to have been attained, in an instant the delightful picture vanishes away, and a sheet of blank blackness takes its place. It is not quite clear, to what this can be attributed ; some kinds of paper are more liable to it than others, from which it would appear that it arises from the condition of the surface. I have, indeed, on some occasions been enabled to trace this blackening, from a little downy pile standing out more prominently from one part than another.

It will be found that papers prepared with a single wash of each of the following solutions—

Bromide of potassium 50 grains, water 1 oz.
Nitrate of silver 100 grains, ditto—

may be used most advantageously for copying any fixed objects. They require but a few minutes exposure, and at any time, the picture may be brought out, by washing with the solution of gallic acid. These photographs, which possess all the requisites of good negative ones, may be

well fixed, by washing with a weak solution of the bromide of potassium or with the hyposulphite of soda.

Papers washed with chloride of gold, freed from an excess of acid, are slowly changed under the influence of the solar beams, a regularly increasing darkness takes place, and the paper at length becomes purple (Herschel). I have observed that the first action of the light is to whiten the paper, which has been rendered a pale yellow by the chloride. If papers are removed from the light when thus bleached, it will be found that a darkening action will gradually come on, and eventually devolope the picture, which may be impressed on the paper. This process is much quickened by placing the paper in cold water.

Chloride of gold with nitrate of silver gives a precipitate of a yellow brown colour, possibly metallic double salts, in which the gold as well as the silver is in the state of chloride. On glass this precipitate is but very slightly sensitive, on paper it is blackened somewhat more speedily (Herschel).

FINIS

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